



GEORGE R.

GEORGE the Second, by the Grace of God, King of *Great-Britain, France,* and *Ireland*, Defender of the Faith, &c. *To all to whom these Presents shall come, Greeting.*
Whereas DENNIS COETLOGON, Gentleman, has by his Petition humbly represented unto Us, that he hath with great Labour and Expence compiled from the best Authors, both antient and modern,

An UNIVERSAL HISTORY of ARTS and SCIENCES;

Containing all Sciences, either divine or human, and all the Arts, either liberal or mechanical, in a more concise and clear Method than heretofore used in any other Work of the Kind; the whole adapted to the meanest Capacity, alphabetically digested, and illustrated with Astronomical and other curious Tables and Prints, which the Petitioner, with the utmost Submission, apprehends may be of the greatest Service to the Publick, as it will be reducing each Art and Science to a regular System, at an easy Rate to the Purchaser, and thereby much encourage every Branch of Learning or Mechanicks; and as the said Work is near finished, and when compleated will cost him upwards of one Thousand Pounds: He therefore being desirous to reap the Fruit of his Labour, and enjoy the full Profits and Benefits that may arise from printing, publishing, and vending the same, without any other Person interfering in his just Property, which he cannot prevent without applying to Us, for Our Royal Licence and Protection: The Petitioner has therefore humbly pray'd Us to grant him Our Royal Licence and Protection, for the sole Printing, Publishing, and Vending the said Work in as ample Manner and Form as hath been done in Cases of the like Nature. We being willing to give all due Encouragement to such a useful Work, are graciously pleased to condescend to his Request; and do therefore by these Presents, so far as may be agreeable to the Statute in that Behalf made and provided, grant unto the said *Dennis Coetlogon*, his Executors, Administrators, and Assigns, Our Royal Privilege and Licence for the sole Printing, Publishing, and Vending the said Work, for and during the Term of fourteen Years, to be computed from the Date hereof, strictly forbidding and prohibiting all Our Subjects within our Kingdoms and Dominions, to reprint or abridge the same, either in the like, or in any other Volume or Volumes whatsoever, or to import, buy, vend, utter, or distribute any Copies thereof, reprinted beyond the Seas, during the aforesaid Term of fourteen Years, without the Consent and Approbation of the said *Dennis Coetlogon*, his Heirs, Executors, Administrators and Assigns, under their Hands and Seals first had and obtained, as they and every of them offending therein, will answer the contrary at their Peril: Whereof the Commissioners and other Officers of our Customs, the Master, Wardens, and Company of Stationers of Our City of *London*, and all other our Officers and Ministers, whom it may concern, are to take Notice, that due Obedience be given to Our Pleasure herein signified. Given at Our Court at St. *James's* the Thirteenth Day of *March*, 1740-1, in the Fourteenth Year of Our Reign.

By His Majesty's Command,
HARRINGTON.



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Universal HISTORY O F ARTS and SCIENCES:

Or, A comprehensive

Illustration, Definition, and Description

O F

All SCIENCES, Divine and Human;

A N D O F

All A R T S, Liberal and Mechanical.

The Origin and Progresses of all RELIGIONS, SECTS,
HERESIES and SCHISMS:

The Description of all COUNTRIES; their Government, Ecclesiastical, Civil and
Military; their different Climates, Soils, Products, and the Manners of the Inhabitants:

The different Systems of PHILOSOPHERS, curious and accurate Observations of
ASTRONOMERS, both Antient and Modern:

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The Whole extracted from

The best AUTHORS in all Languages, and enriched with the new Systems, Hypotheses, Maxims, and
Reflections of the AUTHOR.

By the Chevalier DENNIS DE COETLOGON, Knt. of St. Lazare, M. D.

A N D

MEMBER of the Royal Academy of Angers.

VOLUME the Firft.



L O N D O N.

Printed and Sold by JOHN HART, in Popping's-Court, Fleet-street.

M DCC XLV.



TO THE
HIGH AND MIGHTY LORD

Charles Augustus Fouquet de Belleisle,

DUKE of GISORS,

Marshal of FRANCE, Commander of the King's
Orders; Knight of the Golden Fleece, Prince of the
Holy Roman Empire, Governor of Metz and the *Messin*
Country, and General of his Majesty's Armies.

MY LORD,



HE Arts and Sciences have had the Complaisance
to put an *English* Pen in the Hand of a *French-*
man, to render him capable to express his Gra-
titude to a noble, generous, and brave Nation,
with whom he has lived so long, for their Hospitality, in
Communicating to them Part of the Advantages of his Edu-
cation, having nothing else worthy their Acceptance.

With the same Hand, MY LORD, I take the Liberty to
present the same Arts and Sciences to your GRACE; per-
suaded that they are so familiar to you, that you'll know
them in any Shape, and whatever Language they speak.

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Your

DEDICATION.

Your rare Merit, to which alone you owe all you are, though you are all that the most ambitious Subject, who has no Pretensions to the Throne, can wish to be, assures them of a powerful Protection, which they could expect to find no where but near extraordinary Men like you, whom all *Europe* knows to be a *Mæcenæ*s, or a *Colbert*, in the Cabinet; and a *Turenne*, or *Luxembourg*, at the Head of an Army.

Can I hope, MY LORD, that you'll grant the same Protection to him, who has the Honour to present them to your Grace; and is with the most profound Respect,

MY LORD,

Your Grace's

Most humble, and

Most obedient Servant,

DE COETLOGON.



T H E P R E F A C E.



LEARNING, and the Learned, have been so long in a languishing State in Europe, and Ignorance, Stupidity, and Ribaldry so much encouraged, that it was not without Reluctancy I determined myself to search the Arts and Sciences in those dark Retreats, where the Death of Lewis XIV. the late King of France, their generous Patron, had confined them, and to invite them to make once more their Appearance, tho' in Rags, and cover'd with Dust, in a Country where they have also flourished by Intervals. The Attempt, I confess, was bold, and could not miss being attended with very great Difficulties and Inconveniencies, as well on the Part of the World, as on that of the Sciences; for I was not sure that the World would not be shocked at the Appearance of Things, wherewith they were so little acquainted; and that my Invitation could be agreeable to the Sciences, and they would accept of my Hand to usher them out of their Solitude, in a Country, where my Quality of a Frenchman, might make them be look'd upon with Jealousy or Scorn.

However, the great Familiarity I had contracted from my Infancy, with the Arts and Sciences, and my enterprising Genius, which has led me often thro' the most thorny Paces, have surmounted all those Difficulties, and encouraged me to expose myself to all the Dangers such an Enterprize could be attended with; thro' Consciousness, that if I was obliged to encounter with national Prejudices, as I have really done, I could oppose to it Impartiality, Generosity, Humanity, Hospitality, Gratitude, and all the other Virtues which distinguish the most sensible Part of the English Nation from the rest; and if with Stupidity and Ignorance, I had for a Shelter Minerva's Aegis; as for Avarice, it is so contemptible an Enemy, that I have always despised it.

Those are not the sole Enemies I have had to struggle with in the Prosecution of this Work; for in the very Beginning I was assailed by a strong and formidable Party, who employed all their Craft and low Cunning to prevent my publishing it; Secret Intrigues, Petitions, Calumnies, and all other scandalous Means of that Kind were used to that Purpose, and myself left alone, under national Prejudices, to defeat them; in which I dare flatter myself I have well enough succeeded. Too happy, if I could say the same of those, whom Humanity and Gratitude should have engaged to stand my Friends, and ease me of Part of my Burden, which every impartial, noble, and generous Mind must think has been a very heavy one, by en-

couraging me as much as it was in their Power, and helping me to bear it with Alacrity; especially when they were conscious, that notwithstanding my repeated Invitations, no Body was so kind to lend me a helping Hand, having been obliged to carry on the Work alone, and even write every Line of it with my own Hand, the Index itself not excepted.

In this Work is contain'd the Contents of some hundred Volumes, besides what is my own, which makes above Two-thirds of it; for, I thought, that to give only to the Publick what other Authors have said, would be but a tedious Repetition, if not season'd with something new, to sharpen the Curiosity of the Reader; and that I had as much Right as my Predecessors, to invent new Systems, founded like theirs on Experiments and Reason; so that I can justly claim the Title of the AUTHOR, not of the Compiler of this Work; having borrowed from others, with no other View, than either to shew the Difference between their Systems or Sentiments, and mine; or to refute theirs, when contrary to mine; which every Body that reads my Work must be convinced of; and that my Proofs, both to support my Systems, or corroborate my Refutations, are agreeable to Reason, and to the just Principles of the Art or Science I treat of.

In other Works which bears the Title of Universality, without the Character, it is easy to distinguish the Difference of Hands by the Difference of the Style; but in this, as no other Hand has been employ'd but mine, it is the same Style throughout; which will be a good Caution to the Publick, if ever it falls a Sacrifice to the Stupidity and Ignorance of those, who, in Defiance of all Laws and Equity, lay violent Hands on an Author's Works, to disfigure them, and retail them at a cheap Rate.

Corneille, a French Author, was the first who wrote on all the Arts and Sciences, in general; but his Work was but a Dictionary, which gives only a slight Idea of each Art and Science, of no other Use than to excite our Curiosity, and make it wish for more; tho' it was translated lately into English, with some Additions from other Authors, who have wrote since Corneille; and swelled with an infinite Number of false and inaccurate References, most of the Additions themselves very injudiciously adapted to the Subject, some of them too long for a Dictionary, and others too short; and the whole Work a monstrous Dedalus, which shews evidently a Want of Capacity in the Compilers. Those gross Mistakes, which nothing but a national Prevention, can hinder the Reader from being sensible of, have engaged me to write with Caution to avoid them; and as this Work is of another Nature,

of

of a much greater Utility, and the only one of its Kind in any Language, I have endeavour'd to render every Treatise as compleat as possible, avoiding above all Things needless Repetitions, and never puzzling the Reader with the least Reference; bringing under every Subject all that can be adapted to it; and if I have made a few Treatises longer than some may approve of, it was to oblige the most judicious of my Subscribers, who preferred their Instruction more than the small Sum they might have expected it would have cost them at first; a few others, who in all Appearance knew but little of the Book they were to be Masters of, were continually complaining, that it was carried to a too great Length, without considering that some Authors have filled several Volumes in Folio, with what I have confined within the narrow Limits of a single Treatise. I must confess, that those ungenerous Complaints had been capable either to make me neglect the Work, or dispatch it in a slight Manner, if a serious Reflection that I did not write only for an Age where Learning and the Learned are so little encouraged, and that a judicious Posterity would condemn me, for not having executed what I promised, had not come to the Succour of my Constancy, already much shaken by those unkind Clamours.

I thought I could not begin my Work better than by an historical Account of the several Academies which flourished in Europe, while Luxury and Avarice had not yet debauched the Principles, and depraved the Taste of those, who are obliged in Honour to be their Protector, and who prefer at present a Minuet, or a Rigadoon, to a Problem of Geometry; and the unnatural Voice of an Italian Eunuch, to a Lesson of Philosophy or History; since it was in some of those Schools I have learned what I endeavour to teach others.

In this Work, my Theology, which is divided into several Treatises, the usual Method of the School, and which I promised to follow, contains nothing but what's very orthodox, and agreeable to the Faith of the Primitive Christian Church. All the Questions are fairly stated, the most abstruse Difficulties clearly elucidated; the Propositions strongly supported by the Authority of the Scripture, Œcumenical Councils, antient Fathers, and by Reason; and the Objections refuted, without Partiality, false and religious Prejudices, Animosity or Invectives. I prove the Necessity of Baptism, agreeable to the Doctrine of the Roman and English Church; and treat with Caution, such as becomes a Person who writes in a Protestant Country, that important Point of Controversy the Eucharist; relating without Diminution, or Addition, what the most eminent Theologians of all Ages, from Christianity's Infancy, to our present Time, have wrote of that august Mystery, in their own Words and Language.

I prove the Existence of a supreme Being against the Atheists; the Incarnation of the Word against the Jews, and the Christian Sects, who have erred on that important Event, which has procured an indissoluble Reconciliation between God and Men, and open'd to us the Gates of Heaven.

In these, and all my other Treatises of Theology, especially those contained in the first Volume, I have quoted the Passages whereby I expect to support my Propositions, such as I have extracted them from the Councils, and antient Fathers, that the Reader may not suspect that he is imposed upon by a false Translation, or spurious, or maimed Quotation, but then I take Care either to translate them Word for Word, or give the Sense thereof before, or immediately after. All those Treatises, the Passages of the Scripture, and Quotations from the Councils and Fathers excepted, are mine; as well as those of the Church and Clergy; my Reflections are general, and if I have took Notice of some Abuses, which I thought they could reform, especially as to the Publication of obscene Books, I imagined then it could be done easily; but since I have been informed otherwise, I submit my Judgment to those who are better acquainted with those Affairs. There are no Clergy, let it be said without Flattery, I respect more than that of the Church of England; since I am convinced that for the Generality there are none, whose Conduct is more agreeable to their Profession, and none less addicted to Calumnies, Invectives, and other Imperfections the Tribe of Levi is accused of.

My Chronology, which I flatter myself is as compleat as can be, enriched with a great many rare and curious Events, without Romances or spurious Facts; free from Partiality and national Prejudices, makes Part of my History, which I promised should be both sacred and profane. The History of the New Testament, Judaism, Janfenism, Arianism, Eutychianism, Heresies, Lutheranism, Calvinism, the Councils, &c. compleat the sacred; and Mahometanism, the History of the Pagan Feasts, and Games, the profane. The whole is as impartial as can be; and I have taken a great deal of Care to advance no Facts, which could not be supported by good Authorities, and approved by the best Authors of all Parties, whom I have quoted faithfully; mentioning, without the least Disguise, the good and bad Qualities of those, who, in the different Ages of the Church, have disturbed, by their new Dogma's, her Peace and Tranquility; the Measures she has taken to suppress them, and the great Difficulties she has found in the Enterprise; the Princes who have favoured them most, and the Progresses they have made.

To render my Philosophy more intelligible, and not dwell too long on the same Subject, I have divided it into three different Branches, viz. Ethics, Logick, and Metaphysics, and brought each Branch under its proper Letter; subdividing the fourth, Physick, into several others, viz. Anatomy, Botany, Geography, Geometry, Hydraulicks, Hydrostaticks, Astronomy, Mechanicks, Elements, Metals, Minerals, Meteorology, &c. making of each Subject a whole Treatise by itself, and each Treatise as compleat as my Knowledge of those Sciences would allow, which I hope do not fall short of those written by the most modern Authors; following the Example they have left me of forming new Systems, or Hypotheses; and neglecting nothing that can render them instructive and entertaining.

The Military Art, which is a very prolix and useful Subject, especially at this Conjunction, I have likewise divided into several Treatises, and brought it under the three different Heads of Army, Fortification, and Gunnery; in that of Army I commission Officers, list Soldiers, form Companies, Battalions, Squadrons, and Regiments, assemble Armies, range them in Order of Battle, march, cross Rivers, pass Defiles, escort Convoys, encamp, and do all the other Duties of a General, and of a Soldier.

In Fortification I fortify Places, according to their different Situation, give an accurate Description of every Part thereof, form and carry on Sieges, &c. in which I observe scrupulously all the Rules of that Art prescribed to me by Vauban, Cohorn, Count Pagan, Blondel, and other modern Engineers.

In Gunnery I make Gun-Powder of different Goodness; cast Cannons, and Mortars, caliber them, mount them on their Carriages, supply them with Bombs and Bullets, proportioned to their Caliber, mark their respective Ranges, make an accurate Difference between Pieces of Ordnance of an old and new Invention, give their several Names, and an exact Description of the other Implements of War.

Architecture, Musick, Painting, Sculpture, and the rest of the liberal Arts, make each a compleat Treatise by itself; that of Architecture, illustrated with the best Rules of Vitruvius, Palladio, Vignola, Scammozzi, and other most eminent Architects. Musick, with all the Systems, antient and modern, all the best Rules of that divine Art, the different Sorts of Instruments, their Description, and the Manner they are played upon. Painting, with the Lives of the most famous Painters of all the Schools, and with judicious Remarks on their Works.

My Maxims of Politicks, in Government, the Duties of Ambassadors, and of Plenipotentiaries, and the Education of Princes, are new, and entirely mine.

In the Character of the different Nations of the World, which I give in my Geography, I have been more favourable than could be reasonably expected, since I have passed all their bad Qualities, mentioned by the several Geographers I have consulted, over in Silence; and mentioned none but the good, lest I should disoblige some of them.

The P R E F A C E. 5

At the Request of several Subscribers, I have been prodigal on Commerce; treated of Navigation in a concise and clear Manner, and neglected nothing of what could be said of Naval Architecture.

My Rules of Blazon; in Heraldry, the historical Account I give of the different Degrees of the Nobility, in my Treatise under that Title, and that of all the Military Orders, with an accurate Chronology of the Grand Masters and Knights, of the most celebrated in Christendom, must flatter the Curiosity of Noblemen and Gentlemen.

I have not neglected the mechanical Arts, since I have treated the most useful, and the most in Vogue, with the same Accuracy I have done the liberal; in a Word, I have omitted nothing which I thought could be instructive, useful, and agreeable.

I hope that in the Course of this Work, I have disobliged no Set; for though we differ in our Belief, I notwithstanding respect their Morals; since I have found as many honest Men among Presbyterians, Independents, and the like, as any where else; every Set having its good and corrupted Members; some who act well, tho' they do not think well in Matters of Religion; and others who neither act nor think well. And if I have spoke of some more advantageously than the Publick think I ought, they must not suspect my Candour, but the Partiality of those on whose Relations I have wrote; since I cannot be informed of all those Affairs of myself. I know that I have been accused of being a Papist; so I am, if to love Truth, Justice, and Impartiality is to be one; for I am really a Protestant against Error, Falshood, Injustice, and Calumny.

What I have erred in I submit to the Censure of the judicious and impartial Reader; I hope I have not done it in Point of Faith; and if I have, it is rather through Inadvertency than with a premeditated Design.

Spite, Malice, or a Spirit of Revenge, had no Part in that of Bookselling; I expose the Facts as they really are, without aiming at any Body in particular; since there may be as many honest Men among Booksellers and Printers, as in any other Profession; but I consider what I say of them as a publick Grievance.

I have endeavoured to render my Treatise on Books, useful and entertaining; and hope have succeeded in both, particularly in my Reflections on the Works of the antient Fathers, which proceed from no other Source but my assiduous Study.

It was much against my Design, that some Persons have thought themselves touched by my Reflections on the Conduct of some Apothecaries, when I only aimed at those, who are not duly qualified for that Profession, in which the publick Good is so much interested, having no personal Prejudices against any Body, and always flatter'd myself, that as we are all conscious that many Irregularities are committed daily in all Sorts of Professions, those who are perfect in them, and practise honestly, would be pleased they should be reformed, which cannot be done more effectually, than by cautioning the Publick against them.

The little Care Master Surgeons take, at present, to instruct their Pupils in their Profession, made me think myself obliged to give them a compleat Treatise of that useful and curious Art, which could supply the Deficiency of their Masters. I lead them, as it were, by the Hand, in a gentle and easy Manner, from the first Principles thereof, thro' the most difficult Operations; so that with the Help of this Treatise, and some Practice, which they may acquire in frequenting Hospitals, they may soon become perfect Surgeons; cautioning them, at the same Time, against undertaking any Thing which they do not know, where the Life of the Patient is in Danger, even on the poorest Subject, without calling to their Assistance, those they know understand it better; since that Life is as dear to God as that of a rich Person, and he must equally answer for it; for tho' he may chance to succeed, it is, notwithstanding, a very criminal Presumption to attempt it; which the Hope of performing a great Cure, and the Honour resulting from it, cannot excuse. The more an able Surgeon is sensible of the Danger, the more he is cautious of engaging in it; and though he knows himself capable to attempt any difficult Case, he'll notwithstanding never do it but in the Presence of other Surgeons, as a-

ble as himself, to secure his own Conscience. Why should a Novice in his Art act otherwise? unless he wants to render himself guilty of wilful Murder.

My Treatise of Midwifry, which is a very compleat one, is written for the Instruction of Midwives and Men-midwives; where I describe clearly and intelligibly, all the different Manners of helping a Woman in the most difficult Labour, and the most dangerous. How she is to be treated before, and after her Delivery; the Accidents she is subject to, and how remedied; the Care that must be taken of the Child, his Diseases, and how remedied; with a curious Dissertation of my own on the Small Pox.

Dancing being much encouraged at present by the Great, I have given a concise Treatise of that Art a la mode, which has likewise its Advantages, when practised with Prudence and Moderation.—Dancing teaches us to walk well, and present ourselves well in a Company, and for that Reason, and no other, should be learned by Persons of Rank.

I have not wrote on Gaming with the criminal Design of encouraging it, when it becomes oppressive, or proves the Ruin of Families; since as such I abhor it; but with the View only that one should not appear balked or disconcerted, when he is asked to make a Second or a Third at Picquet, Ombre, Quadrille, or any other Games, in Companies who play only to pass a few Hours agreeably.

Falconry being a noble and princely Pastime or Diversion, deserved a Place in this Work; all Exercises of that Kind, which are oppressive to no Body, deserve to be encouraged, provided they do not take up the Time, which a Prince should employ in the Management of his Affairs, or the Government of his Dominions.

Fowling was inserted here to oblige several Subscribers; and it being an innocent Recreation or Amusement, it really deserves its Place.

Fishing is a Kind of Exercise proper to entertain melancholy Thoughts, and is oppressive to none but to those little Blunderers who fall a Victim to their Greediness; therefore I treat of it with Accuracy, taking Notice at the same Time of its Utility, with Regard to Commerce, in all its Branches; and illustrating the whole with an historical Account of all Sorts of Fish.

I was in Hopes, that my Treatise of Apparitions would contribute much towards rooting out an Evil, which is not the less dangerous because of a very antient Date, and countenanced often by Persons, otherwise of a distinguished Merit, though very injurious to the Divine Providence, contrary to the true Principles of Christianity and to Reason, and very prejudicial to our domestick Peace; as I prove it plainly in the said Treatise, which is entirely mine. I am so great an Enemy to those ridiculous Romances, especially when told to Children, which serves only to terrify their young Minds, and render them ever after pusillanimous, that I think the Legislature in all Countries should decree a severe Punishment against the scandalous Retailers of them.

My Treatise of the Antidiluvians does not proceed from a Principle of Irreligion, as if I questioned the Veracity of the sacred Scripture, for which I have all the Respect that can be expected from a Person educated with Care in the Principles of the Christian Religion, from which I have never deviated, and hope, with God's Assistance, never shall; nor from a ridiculous Insatiation of my own Merit, or Contempt for the learned Authors of those Theories, which, if not true, are ingeniously calculated, particularly that of Mr. Whiston, whose learned Works I have always put on a Level with those of the most celebrated Authors, both antient and modern; but I thought it was needless, and even a Kind of Presumption to have Recourse to Mechanics, Hydraulicks, and Hydrostaticks, to account for what is a Miracle of the Divine Providence, founded on Revelation, and in some Measure to a natural Cause, what was an Effect of the Omnipotency of a supreme Being, who having been capable to form the Water from nothing, is capable, likewise, to bring a sufficient Quantity of it over the Face of the Earth to drown the human Race, without disordering the marvellous and admirable Symmetry he

he had established between the Parts it was composed of; especially when he design'd to people it again with a new Generation. It is true, that I confine that Deluge to that Part of the Earth which was then the only one inhabited; because, as we learn from the sacred Writ, that that Prodigy was effected to punish the Sins of Mankind, I think it repugnant to God's infinite Mercy and Justice, to involve in the same Punishment the other Parts which had not sinned, and could not have sinned, since they were not inhabited; it being needless besides to wash what had not been polluted.

Neither do I pretend, in my Treatise of Alchymy, to reflect on Moses, when I say he might have very well pass'd for an Alchymist, or question what he tells us of the Spoil of the Egyptians; for I consult then my Reason only, which can never be convinced, that the Hebrews, so much despised and maltreated in Egypt, could borrow such immense Sums from the Egyptians; the Authority of the Scripture, only, which every Body knows must in many Cases silence our Reason, can persuade me of the Truth of that History, and I submit to it with Pleasure and Respect; never pretending to maintain my Sentiments with Obstinacy; being always ready to expunge with my own Blood, any of them which could be thought to smell in the least of Error, or Schism.

My Impartiality in the historical Account of Calvinism; where I have related nothing but undeniable Facts, agreed upon by the most impartial Authors of all Parties, whom alone I have consulted, must have pleased them who are not actuated by Motives of Jealousy, Envy, and Malice; since I am persuaded, that they will not find in the whole Treatise, the least Falshood, Satyr, Calumny, or

Invective. I hide none of Calvin's, or his Partisans Perfections, but I am equally impartial with Regard to their Demerit; which is all that can be expected from a faithful Historian.

Ethicks, or Morality, so much encouraged, and so well cultivated by the Antients, and calculated for the Good of the civil Society, has took much of my Time, which could not be better employed, but in reviving those salutary Rules so long neglected by the Generality of Mankind; Immorality, Luxury, Ambition, Avarice, Self-Love, Self-Conceit, Deceit, Treachery, Injustice, having got the upper Hand, and almost banished Virtue from among us. What tacit Reproach to us, that those first Moralists, and those Pupils who follow'd so scrupulously their salutary Lessons, were Persons who had not a just Notion of a supreme Being, and nothing to engage them to the Practice of Virtue, but its Amiability! What Shame for us, that they should be actuated by that single Motive, when every Thing else, their false Worship not excepted, induced them to Vice and Debauchery.

To oblige one of my Correspondents and Subscribers, I have wrote a Dissertation on Friendship, in my Treatise of Societies; and wished often, that a Person of his distinguished Merit had been pleased to communicate to me some of his excellent Thoughts on that important Subject; but he was contented with insisting on my writing that Dissertation, without letting me know whether it pleased him or not.

I hope this very short Abridgment of my Work, which I had design'd should, and ought to have been less concise, will be, notwithstanding, of some Help to the Reader to understand better what follows.





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Stephen Clutterbuck, Esq; Bristol.
Henry Combe, Esq; Bristol.
John Coraud, Esq;
Mr. John Cartwright, Gent.
Mr. Gilbert Clarke, Gent.
Mr. Carlos, Bookseller, at Norwich, two Setts.
Mr. William Casson, Letter-Founder.
Mr. Daniel Chandler, Supervisor of Excise, at Basingstoke,
 Hants.
Mr. Matthew Clover, Custom-House, Newcastle upon Tine.
Mr. William Cooke, Surgeon, at Newport, Isle of Wight.
Mr. Ralph Carr.
Mr. Abel Clifton, at Yarmouth.
Mr. Thomas Carefoot.
Mr. Thomas Clarke, Bricklayer, near Bishopsgate.
Mr. Edward Crofswell.
Mr. Edward Coulson.
Mr. Chasent.
Mr. Thomas Clark.
Mr. Cary.
Mr. Cookson.
Mr. Calender.
Mr. Henry Crane.
Mr. Richard Crofsweller.

D.
Rev. Mr. Richard Davies.
Anthony Drummond, Esq;
George Dennings, Esq; of Putney.
Mr. Isaac Delvalle, Merchant.

Captain Dalgardno.
Mr. John Dagley.
Mr. Charles Delafosse.
Mr. Robert Dent, Tower.
Mr. William Dalstone, of Coatham near Darlington.
Mr. James Dagnia, South-Shields.
Mr. Samuel Dale.
Mr. Thomas Davy, Schoolmaster in Norwich.
Mr. Tho. Dawson, at Norwich.
Mr. Deninton.
Mr. James Desloge.
Mr. Nich. Durand.
Mr. William Dymock.

E.
Mr. Eaton, Bookseller, at Yarmouth, three Setts.
Mr. Henry Eeles, Apothecary, of Twickenham.
Mr. Thomas Ellis of Lound, Suffolk.

F.
Peter Forbes, Esq;
 — Freeman, Esq; University-College, Oxon.
Mr. Fairbank, Apothecary, in Bettley, Staffordshire.
Mr. Fleming, Bookseller, Newcastle upon Tine.
Mr. John Fox, Bromyard, Herefordshire.
Mr. William Francis of Chester.
Mr. Richard Franks, Bristol.
Mr. Ingham Foster.
Mr. Farrer.

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Joseph Gape of the Middle Temple, Esq;
William Gildafs, Esq; of Barton upon Humber.
Mr. Stephen Galhie, Stuart-Street, Artillery-Ground.
Mr. William Gee, at Manchester.
Mr. John Goodall of Hartis in Suffolk.
Mr. John Gifford.
Mr. Robert Gibson.
Mr. Ralph Good.
Mr. John Good.
Mr. John Goodchild.
Mr. John Goodwin of Norwich.
Mr. Henry Gough, Bristol.
Mr. — Griffiths, Gent.
Mr. Peter Glizziere.
Mr. John Green, Plumber, Newent, Gloucestershire.
Mr. Thomas Grey at Cawsey.
Mr. Richard Green.

H.
Rev. Mr. Holmes of Northamptonshire.
Rev. Mr. Hall.
William Hall, Esq;
Nathaniel Hone, Esq;
 — Hibberdine, M. D. of Swarford, two Setts.
Mr. James Harrison, Attorney at Law.
Mr. Robert Hayward, Bristol.
Mr. Robert Hall, Schoolmaster, Newcastle upon Tine.
Mr. Hammond of Stratton Ardley.
Mr. Richard Hand, near Chelsea-College, Baker.
Mr. Robert Hartwell, Tower.
Mr. Hill, Printer, at Cirencester.
Mr. Samuel Hill, at the Brick-Yard, near Bristol.
Mr. Hill.
Mr. Thomas Holmes at Yarmouth.
Mr. Ralph Hopper, Excise-Officer, Morpeth, Northumberl.
Mr. Mark Horfman.
Mr. John Huddleston.
Mr. Newark Hudson at Chater Haugh, County of Durham.
Mr. Richard Humble, jun. at Berkley, ditto.
Mr. James Hynes.

I.
Rev. Mr. Henry Jervis, at Advastone, near Drayton,
 Shropshire.
Mr. John James, Letter-Founder.
Mr. Jamesone.
Mr. Hugh Jeboult, Sarum.
Mr. John Jefferies, jun. Westminster.
Mr. — Jefferies of Coventry.
Mr. William Jeffreys, Surgeon, at Twickenham.
Mr. Jonathan Jewett, Newcastle upon Tine.
Mr. Edward Jones of the Custom-House.
Mr. Thomas Jones, of the Lottery-Office.
Major John Johnson.

Mr. Peter Joynson, *Printer*, Chester.
Mr. James Irwine, *Surgeon*.

K.

Serjeant Ketelby, deceased.
Mr. John Kinch, *Fairford*, Gloucestershire.
Mr. Thomas Kirkes, *Gent.* of Chester.

L.

Rev. Dr. Latham in *Sunderland*.
Rev. Mr. Laughton, at *Long Sutton*, in *Lincolnshire*.
Mr. Benjamin Lorkin, *Merchant*.
Mr. John Lloyd, *Attorney*, *Newcastle upon Tine*.
Mr. John Lowthan, at *ditto*.
Mr. Nat. Lee, *Attorney*, at *Glocester*.
Mr. Brice Lambert, of *Peterham*, *Surrey*.
Mr. Thomas Langdale.
Mr. William Laycock.
Mr. Thomas Layton.
Mr. Larooe, *Grocer*, *Thorney*, *Cambridgeshire*.
Mr. John Leckie.
Mr. Charles Lee, at the *Post-Office*.
Mr. John Leech, *Bookseller*, in *Knatford*, *Cheshire*.
Mr. William Linley, *Feyner*, *Badmington*, *Gloucestershire*.
Mr. William Lloyd, *Silversmith*.
Mr. William Lock, *Carver*, at *Catton near Norwich*.
Mr. Richard Luckman, *Fairford*, *Gloucestershire*.
Mr. James Leyburn.

M.

Rev. Mr. Mouline.
Mr. John Moulson, *Merchant*, at *Chester*.
——— *Montgomery, Esq;*
——— *Moore, Esq;*
Mr. William Monk, at *Chester*.
Mr. John Mapletost, at *Windfor*.
Mr. Robert Marley, at *Dunstone*, *County of Durham*.
Mr. Thomas Mashiter.
Mr. John Marshal.
Mr. Job Mathews.
Mr. Middleton of *Wellingborough*, *Northamptonshire*.
Mr. Stephen Montague, *jun.*
Mr. Moreland of *Whitney*, *Oxfordshire*.
Mr. William Miller.

N.

Mr. Anthony Nicholson, of the *Inner Temple*, *Gent.*
Mr. Israel Noyes, *Bristol*.
Mr. Thomas Nash, at the *Fire-Engine near Bristol*.
Mr. Benjamin Newman, *Dyer*, *London*.
Mr. Samuel Newton.

O.

Colonel Ogilvie.
Rev. Mr. Oddley.
Mr. William Ofeland, *Lighterman*.
Mr. Robert Obrian, *Sarum*.

P.

His Excellency the Portugal Ambassador.
Rev. Mr. Nathaniel Philpot, *Chester*.
Rev. Mr. William Petiphar, *M. A.*
Rev. Mr. Patterson, *M. A.*
John Pooley, *Esq;* at *Boxsted* in *Suffolk*.
Mr. Samuel Pennington, *Register* of *Northampton*.
Captain Gilbert Pringle.
Dr. Pringle.
John Popham, *Esq* at *Newport*, *Isle of Wight*.
Mr. Reginald Partridge, *Gent.*
Mr. Thomas Pugh, *Gent.*
Mr. Jacob Patterson, *Mercer*, of *Witham*, *Essex*.
Mr. Thomas Paine, *Bookbinder*.
Mr. Nathaniel Par, *Engraver*.
Mr. Isaac Paradise at *Calne*.
Mr. Pawson.
Mr. Joseph Peachy of *Norwich*.
Mr. John Peat.
Mr. Edward Phillips, *Schoolmaster* in *Wrexham*.
Mr. William Phillips, *Painter*.
Mr. John Piggott.
Mr. James Poole of *Norwich*.
Mr. Portlock of *Leicester*.
Mr. Isaac Poultum, at *Yarmouth*.
Mr. John Poyner.
Mr. John Pratt, at *Lambton*, *County of Durham*.
Mr. Pybus of *Ardley*, *Oxfordshire*.

Q.

Mr. Quam.
Mr. Quin.

R.

Mr. Raikes, *Printer*, at *Gloucester*.
Mr. John Ramey, at *Yarmouth*.
Mr. Henry Reading.
Mr. Samuel Reeve.
Mr. John Richardson, *Apothecary* in *Colchester*.
Mr. William Richardson, at *Richmond* in *Surry*.
Mr. Francis Richardson.
Mr. ——— *Richmond*.

Mr. George Rigg, *Philomath*. *London*.
Mr. Richmond Riggs.
Mr. George Ridout, *Silversmith*.
Mr. Jer. Roe, *Bookseller*, at *Derby*.
Mr. Robinson.
Mr. Anthony Robson, *Merchant*, *Newcastle upon Tine*.
Mr. Alexander Robertson.
Mr. William Roberts, *Carpenter*, at *Gloucester*.
Mr. Roston Roberts.
Mr. Roles, *Apothecary*, in *Thorney*, *Cambridgeshire*.
Mr. Thomas Rockett, at the *Hough*, near *Nantwich*.
Mr. James Rochell.
Mr. Robert Roddam.

S.

His Excellency the Sardinian Ambassador.
James Stonhouse, *M. D.* *Physician to the County Infirmary*, at *Northampton*.
Rev. Mr. Smith, *Chaplain* of *St. Saviour*, *Southwark*.
Rev. Mr. William Simcoe, of *Woodhorn*.
Mr. Thomas Seston, *Merchant*, at *Chester*.
Mr. William Stevens, of the *Navy-Office*, *London*.
Mr. Simon Stratford, *Gent.*
Mr. William Speer, *Gent.* *Clerk in his Majesty's Treasury*.
Mr. John Speer, *King-street*, *St. James's-Square*.
Mr. Richard Stephenson at *Gibside*, *County of Durham*.
Mr. John Scurfield, at *Usworth*, *County of Durham*.
Mr. Thomas Steel, at *North Disington*, *Northumberland*.
Mr. John Stokes, *Upper Grosvenor-Street*.
Mr. Richard Shermore of *Oakley*, *Wiltshire*.
Mr. Thomas Smith, at *St. Paul*, *Shadwell*.
Mr. Edward Sexton.
Mr. Sheelds.
Mr. Sotro.
Mr. John Stevenfon.
Mr. Steadman.
Mr. Stone.

T.

Rev. Mr. Thompson, in *West-gate*, *Newcastle upon Tine*.
John Thornhill, *Esq;* *Serjeant Painter to his Majesty*.
John Trevanion, *Esq;*
Mr. John Thornhill, in *Sunderland*.
Mr. Edward Thorpe, of *Kingston upon Thames*.
Mr. James Thomas.
Mr. Robert Todd.
Mr. Treadway, *jun.*

V.

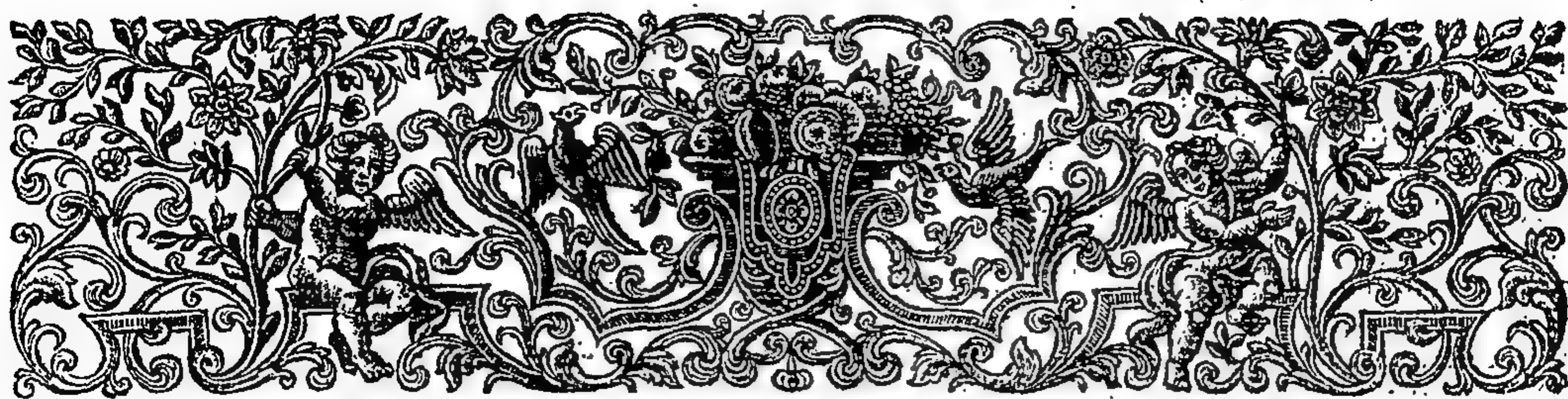
Charles Vernon, *Esq;*
Rev. Mr. Venables, *Chipping-norton*, *Oxfordshire*.
Rev. Mr. Thomas Vaughan, *M. A.* of *Northumberland*, late of *Lincoln College*, *Oxon*.
Mr. William Vick.
Mr. George Vincr.

W.

Rev. Dr. John Waugh, *Chancellor* of *Carlisle*.
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Walter Warburton, *Esq;* of *Chester*.
Ralph Widdrington, *Esq;* in *Northumberland*.
Cornelius Wittenoom, *Esq;*
Mr. Henry Watson, *Merchant*, *Newcastle upon Tine*.
Edward Weaver, *M. D.*
Mr. Richard Whitfield, *Gent.*
Mr. William Winston, *Gent.*
Mr. Thomas Wade, *Officer of Excise* at *Stanmore*.
Mr. Arnold Warren at *Greenwich*.
Mr. Edward Walker.
Mr. John Wall.
Mr. Thomas Wallis, at *Sarum*.
Mr. George Wattson, of *Whittlesey* in *Cambridgeshire*.
Mr. Thomas Wayne, *M. P. S.*
Mr. William Wharton.
Mr. Henry Fotherley Whitfield of *Rickmansworth*, *Hertfordshire*.
Mr. Robert White, at *Yarmouth*.
Mr. Samuel White.
Mr. William Wilcocks.
Mr. Peter Wilder, *Bristol*.
Mr. John Williams, *Surgeon*, *Bromyard*, *Herefordshire*.
Mr. Thomas Williams, *Cheese-Pastor*, *Nantwich*.
Mr. William Williams, *Bristol*.
Mr. Edward Winch, *Surgeon and Apothecary* at *High Wycomb*, *Bucks*.
Mr. Joseph Wingfield.
Mr. Winpenny, *Printer*, at *Bristol*.
Mr. John Wood.
Mr. John Woodfield, *Engraver*.
Mr. William Woothend.
Mr. Arthur Wright of *Scaldwell*, *Northamptonshire*.
Mr. George Wyatt, *Philomath*. *London*.
Mr. William Wychingham.

Y.

Mr. Daniel York of *Thrapston*, *Northamptonshire*.
Mr. Yeaman.



A N

Universal HISTORY

O F

ARTS and SCIENCES.

ACADEMY.



CADEMY is a regular Society, or Company of learned Persons; instituted under the Protection of a Prince, for the Cultivation and Improvement of Arts and Sciences.

The Difference between *Academy* and *University* is, that an *University* is properly a Body composed of Graduates in the several Faculties; of Professors who teach in the publick Schools; of Regents, or Tutors, and Students who learn under them, and aspire likewise to Degrees; whereas an *Academy* is not intended to teach or profess any Art, such as it is, but to improve it.

ACADEMY takes its Name from one *Academus*, or *Ecademus*, a Citizen of *Athens*, who established the first *Academy* in the Suburbs of that City, in a fine Villa, a Mile from it; where *Plato*, and the Wits who followed him, held Assemblies for Disputes and Philosophical Conferences; and which gave the Denomination to the Sect of *Academicks*.

Academicks, were a Sect of Philosophers who followed the Doctrine of *Socrates* and *Plato*, as to the Uncertainty of Knowledge, and the Incomprehensibility of Truth.

Their original Dogma was this, *Unum scio, quod nihil scio*, I know this one Thing, that I know nothing; which was afterwards improved into, *Nihil scio, ne hoc quidem, quod nihil scio*, I know nothing, not even this, that I know nothing. Accordingly they pleaded that the Mind ought always to remain in Suspense; as having nothing to determine on but bare Probability or Verisimilitude, which is as likely to lead into Error as Truth.

This Distrust and Doubt of every Thing which *Plato* recommends to his Disciples, was not so much to leave them fluctuating between Truth and Error, as to caution them against those rash and precipitate Decisions young Minds are subject to; and to dispose them to secure themselves from Error, by examining every thing without Prejudice.

Though *M. des Cartes* hath adopted the same Principle of doubting of every Thing, he makes a very different Use of it. — The Difference between the antient *Academicks* and this modern one, is, that the antient *Academicks* doubted of every Thing, and were resolved to continue in their Fluctuation; whereas *M. des Cartes* doubts of every Thing; but declares, that he only doubts at first, that his Determinations, afterwards, may be the surer, which once obtained, he is resolved to doubt no longer. — *Plato* doubted through fear of being mistaken in his Decisions, and therefore is resolved to doubt always. — *Des Cartes* doubts to acquire a greater, or the sublimest Knowledge, and consequently doubted only for a certain Time.

The first *Academy* in *Europe*, was founded at *Paris*, by *Charlemagne*, under the Direction of *Alcuin*, (whom some suppose an *English* Man) it was composed of the first Wits of the Court, each distinguished by the Name of some antient Author who pleased him most. *Alcuin* took that of *Flaccus*; a young Lord, named *Angilbert*, that of *Homer*; *Adelard*, Bishop of *Corbie*, was called *Augustin*; *Riculf*, Bishop of *Mentz*, *Dametas*; and the King himself *David*. In their Academical Conferences, every *Academist* was to give an account of what antient Authors he had read, with some judicious and learned Reflections of his own, which could convince the rest of the *Academists* that he understood what he had read.

Some Authors pretend, that what *Charlemagne* founded, then, was not an *Academy*, but a School for the Instruction of the young Nobility and Gentry of his Kingdom, where *Alcuin*, who had been the first Promoter of it, was appointed the first Professor, and that that School has continued since, under the Denomination of the *University of Paris*; which is the more probable Opinion; and which could not have hindered the greatest Wits, and the most learned Persons of the Court, not even the King himself

from resorting thither, for a further Improvement, or to make Parade of their Wit and Merit, as it is still the Custom in *France*, on any publick Act or Disputation.

Most Nations have now their *Academies*, *Russia* not excepted; but of all Countries *France* bears the Bell in this Respect.—We have but few in *England*; the only one of Eminence is called by the Name of the *Royal Society*.

This *Academy* was instituted by King *Charles II.* for the promoting of natural Knowledge. It had its Original in an Assembly of ingenious Men, who before the Restauration met weekly in *Wadham College* in *Oxford*, at the Lodgings of Dr. *Wilkins*.

Afterwards, from about the Year 1658, many of them living in *London*, held Meetings at *Gresham-College*; till they were at length taken notice of by the King, who was pleased to grant them an ample Charter, dated the 22d of *April*, 1663; whereby they were erected into a Corporation, consisting of a *President*, *Council*, and *Fellows*, for promoting the Knowledge of natural Things, and useful Experiments. Their manner of electing Fellows is by Balloting. Their Council are in Number twenty-one, eleven of which are continued for the next Year, and ten more added to them, all chosen on St. *Andrew's Day*.

Each Member at his Admission subscribes an Engagement, that he will endeavour to promote the Good of the Society; from which he may be freed at any Time, by signifying to the President that he desires to withdraw.

The Charges are 40*s.* paid to the Treasurer at Admission; and 13 *s.* per Quarter, so long as the Person continues a Member.

Their Design is “to make faithful Records of all the Works of Nature, or Art, which come within their Reach; so that the present, as well as after Ages, may be enabled to put a Mark on Errors which have been strengthened by long Prescription; to restore Truths that have been neglected; to put those already known to more various Uses; to make the Way more passable to what remains unrevealed, &c.

To this Purpose they have made a great Number of Experiments and Observations, on most of the Works of Nature; Eclipses, Comets, Meteors, Mines, Plants, Earthquakes, Inundations, Springs, Damps, subterraneous Fires, Tides, Currents, the Magnet, &c. Also a Number of short Histories of Nature, Arts, Manufactures, useful Engines, Contrivances, &c. The Services they have been of to the Publick are very great.—They have improved naval, civil and military Architecture; advanced the Security and Perfection of Navigation; improved Agriculture; and put, not only this Kingdom, but also *Ireland*, the Plantations, &c. upon planting.

They have registered Experiments, Histories, Relations, &c. and reduced them into a common Stock: have from Time to Time published some of the most immediate Use, under the Title of *Philosophical Transactions*, &c. and laid the rest up in publick Registers, to be nakedly transmitted to Posterity, as a solid Ground-work for future Systems.

They have a Library adapted to their Institution; towards which the late Earl Marshal contributed the *Norfolcian Library*; and a Museum, or Repository, of natural and artificial Rarities, given them by *Daniel Colwal*, Esq;—Their Motto, *Nullius in verba*.

This illustrious Body is composed of Persons eminent for their Birth, and for their Eminence in the Arts or Sciences, they profess; Princes not excepted.

Besides this, we have a Royal *Academy* of Musick, and another of Painting, established by Letters Patent, and governed by their respective Directors; but I don't believe they are at present in a very flourishing Condition.

The *French* have flourishing *Academies* of all Kinds,

established at *Paris*, mostly by the late King,——*viz.* the

Royal *Academy* of Sciences for the Improvement of Physicks, Mathematicks, and Chymistry; first erected in 1666, by Order of the King, though without any Act of Royal Authority issued for that End.—In the Year 1699, it had, as it were, a second Birth; the same Prince, by a Regulation dated the 26th of *January*, giving it a new Form, and putting it on a new and more solemn Footing.

In Virtue of that Regulation, the *Academy* was to be composed of four Kinds of Members, *viz.* *Honorary*, *Pensionary*, *Associates*, and *Eleves*.—The first and last to consist of ten Persons, and the rest of twenty each.—The *Honorary Academists*, to be all *Regnicoles*; the *Pensionaries*, all to reside at *Paris*; eight of the *Associates*, allowed to consist of Foreigners; and the *Eleves*, all to live at *Paris*.—The Officers to be a President, named every Year by the King out of the Class of *Honorary Academists*; and a Secretary, and Treasurer, to be perpetual.

Of the *Pensionaries*, three to be Geometricians; three Astronomers; three Mechanicks; three Anatomists; three Chymists; three Botanists; the remaining two, Secretary and Treasurer.—Of the twelve *Associates*, two to apply themselves to Geometry; two to Botany; and two to Chymistry.—The *Eleves* to apply themselves to some Kind of Science, with the *Pensionaries* they are attached to; and not to speak, except when called thereto by the President.—No Regular or Religious to be admitted, except into the Class of *Honorary Academists*; nor any Person to be admitted, either for Associate or Pensionary, unless known by some considerable printed Work, some Machine, or other Discovery.—Further, no Person to be allowed to make Use of his Quality of *Academist*, in the Title of any of his Books, until such Books have been read to, and approved by the *Academy*.

The Meetings of the *Academy* were to be held twice a Week in the King's Library, (though, soon after, they were removed to a more commodious Apartment in the *Louvre*) and to last at least two Hours, from three to five. At the Beginning of every new Year, each Pensionary to be obliged to declare in Writing, what Work he intended chiefly to prosecute that Year; and the rest to be invited to the same.—All the Observations the *Academists* bring to the Meeting, to be left in Writing in the Hands of the Secretary; who is to enter the Substance of what passes at each Assembly in a Register; and at the End of every Year to publish the History, or Transactions of the *Academy*, for that Year.

None but Members to be present at their ordinary Meetings; unless such as are introduced by the Secretary, to propose some new Machine or Discovery; though their Publick Meetings twice a Year, shall be open to every Body.

To encourage the Members to continue their Labours, the King engages, not only to pay the ordinary Pensions, but even to give extraordinary Gratiifications, according to the Merit of their respective Performances; furnishing withal, the Expence of the Experiments, and other Inquiries necessary to be made.—If any Member gives in a Bill of Charges of Experiments which he has made, or desires the Printing of any Book, and bring in the Charges of Graving, the President allowing and signing it, which is seldom or never denied, the Money is immediately paid by the King.—So if an Anatomist require live Tortoises; for Instance, for making Experiments about the Heart, &c. they shall be brought him, as many as he pleases, at the King's Charge. *List. Journ. to Paris*.—Their Motto, *Invenit & perfectit*.

In the Year 1716, the Duke of *Orleans*, then Regent, made an Alteration in their Constitution; as his Royal Highness was determined to invite over as many as he could of foreign Artificers or Mechanicks, who excelled in some Art or Profession, which had

not been brought yet to their Perfection in *France*; he augmented the Number of Honoraries, and of Associates, capable of being Foreigners, (LAWS, after that Regulation, having been made one of the Honorary Members of that illustrious Society) and admitting Regulars among such Associates; suppressing the Class of *Eleves*, and establishing, in lieu thereof, a new Class of twelve Adjuncts, to the six several Kinds of Sciences cultivated by the *Academy*; and lastly, appointing a Vice-President, to be chosen yearly by the King, out of the Honorary Members; and a Director, and Sub-Director out of the Pensionaries.

Their Secretary, *M. de Fontenelle*, hath obliged the Publick with twenty-eight Volumes of the Productions, of this illustrious Body, under the Title of *Histoire de l'Academie Royale, &c. avec les Memoires de Mathematique, & de Physique tires des Registres, &c.*

The *French Academy*, established under *Lewis XIII.* by Cardinal *Richlieu*, for the Improvement of the *French* Language, is the next in Dignity, and composed of forty Members, called *Les quarante de l'Academie*. The most distinguished Persons of the Church, the Sword, and the Gown, have been Members of that illustrious Society; there are always among them Princes, Dukes, Marshals of *France*, Cardinals, Archbishops, Bishops, *Presidents a Mortier*, Abbots, &c. &c.

This *Academy* distributes two Prizes yearly; one of Eloquence, founded by *M. de Balzac*; the other of Poetry, founded by the *Academy* herself. The Subject of that of Eloquence, must be, according to the Intention of the Founder, taken from some of the Books of the *New Testament*, and proposed by the *Academy*; and that of Poetry, the Praises of the King, proposed also by the *Academy*.

Every Discourse of Eloquence written for the Prize, must be of Half an Hour's reading.

None of the *Academists* is allowed to write for the Prize; but after its Distribution, the Subject for the ensuing Year having been chosen by the Assembly, is rendered Publick, that every Body (Foreigners not excepted) may have the Opportunity to exercise his Pen.—Where a Person has wrote on the Subject proposed, he can direct his Discourse to the Secretary of the *Academy*, with a Motto, and some Letters, or *Characters*, whereby the Author might be known, in Case he carry off the Prize.

Those Discourses, as well as the Poetry, are carefully and impartially examined, by some of the most select *Academists*, appointed by the whole Society for that Purpose; and the Day appointed for the Distribution of the Prize, the Discourse, or Piece of Poetry, judged to have deserved it, with two others which are come nearer to it, are read publickly, and ordered to be printed.

Mr. Perault, Secretary of the *Academy*, had collected those Pieces of Eloquence and Poetry, into nineteen Volumes, whose Number has been augmented since.

The Beauty of the *French* Language depends entirely on the Caprice of those forty Members; who after a long and tedious Labour, have favoured us at last with a Dictionary, intituled *Le Dictionnaire de l'Academie Francoise*.

The *Academy* had so long promised the Publick that useful Work, without performing her Promise, that the *French* were almost out of Hope of seeing it ever come out; and some of them pretend that which hastened its Publication, was a judicious *Repartee* of the Doctor, in the Farce of *Harlequin* Emperor of the *Moon*, where the *Emperor's Messenger*, or *Ambassador*, being asked News of that vast Empire, says, among other Things, that in the Dominions of the Emperor his Master, forty grave and very learned Persons, had been above forty Years composing a Dictionary, to perfect the Language of the *Lunatics*, which difficult Task they had not been able yet to compass; *C'est tout come ici*, replied the *Querist*, that *tout come ici*, says the *French*, did bring in a few Months

Time, the Dictionary to Light, which otherwise had been kept longer in the Dark.

The *Academy* of Painting and Sculpture was established under the Cardinal *Mazarin*, first Protector thereof; and the Chancellor *Seguier*, Vice-Protector.

It consists of a Director, a Chancellor, four Rectors, a Treasurer, twelve Professors; *Adjuncts* to the Rectors, and Professors; Counsellors; a Secretary; a Professor for Anatomy, and another for Geometry and Perspective.

Persons are here admitted either in Quality of Painters or Sculptors.—The Painters are admitted according to their respective Talents; there being a Distinction made between those who work in History, and those who only paint Portraits, Landscips, Beasts, Fruits, or Flowers, or paint in Miniature; or only design, engrave, or carve, &c.—Their Productions are exposed to publick View yearly, in the great Hall of the *Louvre*; and there are Prizes for those who perform best.

There is also an *Academy* of Painting, Sculpture, &c. at *Rome*, established by *Lewis XIV.* wherein those who have won the annual Prizes, in the like *Academy* at *Paris*, are received and entertain'd for three Years, to give them an Opportunity for perfecting themselves.

The *Academy* of Medals, and Inscriptions, was erected for the Study and Explanation of antient Monuments; and to consecrate great and memorable Events to Posterity, by similar Monuments; as Medals, Relievo's, Inscriptions, &c.

There is also at *Paris* an *Academy* of Politicks, composed of six Persons, who meet on certain Days, each Week, at the *Louvre*, in the Chamber where the Papers relating to foreign Affairs are lodged.—Here they peruse such Papers as are put in their Hands, by order of the Secretary for foreign Affairs; who informs the King of the Progress they make, and the Capacities of each, that his Majesty may employ them accordingly.—For my Part I never heard that this *Academy* has ever been in a very flourishing Condition; nor that the King of *France* would intrust any body else but his Ministers with the Inspection of his foreign Affairs.—The best established *Academy* for that Purpose, is his *Cabinet*, and his Ministers the only *Academists*.—Not but those six Persons, who meet weekly at the *Louvre* to perfect themselves in Politicks, and thereby render themselves capable of serving their Prince, in the Capacity of a Secretary of State, or foreign Ministers, may be sometime consulted on some particular Affair, but seldom or never intrusted with the Perusal of Papers relating thereto; else those Affairs would not be always conducted with so much Secrecy.—Such Perusal would appear entirely contrary to the Maxims of the *French* Court.—However, if such an *Academy* was established in all Countries, there would not be so many Blunders committed in the Management of foreign Affairs.

The *Academy* of Musick, is no other than the Managers and Directors of the Opera, which has been in a declining State in *France*, ever since the Death of the famous *John Baptist Lully*, an *Italian*, brought over by the late King *Lewis XIV.* and made by him, Superintendant of his Musick.—That excellent Man had found the Secret to bring the *French Orchestre* to its greatest Perfection, by mixing the *Italian* Softness with the *French* Taste. His *Opera's* are still new, and heard with a great deal of Pleasure and Applause; and will continue so to the latest Ages.—*Lewis XIV.* himself had a very good Taste for Musick; and was a very great Judge of all the Performances of that Kind.—His Majesty used to beat the Times himself, with his Foot; and *Lully*, who had always his Eyes fixed on the King, while the Performance lasted, knew by his Majesty's Motions, when the Performers had committed some Faults, better than if he had depended entirely on his own Judgment.

The

The French have also *Academies*, in most of their great Cities; as at *Montpelier*, the *Academy* of Sciences; at *Toulouſe*, that of the *Lanterniſts*; at *Niſmes*, *Arles*, *Angiers*, *Caen*, &c.

The Duke d'*Escalona* eſtabliſhed at *Madrid*, in 1714. with the King of *Spain*'s Approbation, an *Academy*, for cultivating the *Caſtilian* Tongue. — It conſiſts of twenty-four *Academiſts*; including the Director and Secretary. — His Catholick Maſteſty declared himſelf Protector thereof. — The Device of that *Academy* is a Crucible on the Fire, with this Motto, *Limpia ſija, y da Eſplendor*.

Italy alone has more *Academies* than all the reſt of the World, but none of them very famous, tho' accounted ſuch by thoſe who have never ſeen them; unleſs they keep to themſelves all the Discoveries they make. — Their greateſt Improvements are in Muſick and Painting, tho' they have much degenerated in thoſe Arts from the Skill of their Anceſtors. — I have had the Honour myſelf, of being introduced into ſome of thoſe *Academies*, particularly at that of the *Diffetuoſi*, at *Boulogna*, where I found, that in Effect the *Academiſts* were very deficient in almoſt every Thing. Their Exerciſes are not conducted with that Strength of Imagination, that Vivacity, and Quickneſs of Invention, nor with that profound Knowledge and Experience, to be met with in other Countries, tho' the *Italians* are very vain of the Title of *Academiſts*, which to them, ſeems an eſſential Part of a regular Conſtitution. — At *Milan* only, there are twenty-five *Academies*, and five hundred and fifty in all *Italy*, differenced by the humorous Titles of *Anſioſi*, *Ocioſi*, *Sopiti*, *Reſvegliati*, *Diſcordanti*, *Accuti*, *Adagiati*, *Aſſidati*, *Raſfrontati*, *Agitati*, *Infermati*, *Intronati*, &c. &c.

There is alſo in *Germany* an *Academy* of *Naturæ Curioſi*, founded in 1652. by M. *Bauſch*, a Phyſician, and taken in 1670, under the Protection of the Emperor *Leopold*.

But the moſt famous in thoſe Parts, is the *Academy des Princes*, erected at *Berlin* in 1703. by *Frederick I.* King of *Pruſſia*, for the Education of the young Nobility of the Court ſuitable to their Extraction; and which is ſo likely to receive a new Luſtre, under the Protection of his preſent *Pruſſian* Maſteſty; a Prince adorned with all the Merit, excellent Qualities, and rare Perfections, capable to form a King and a Hero; who, to ſhew his profound Knowledge, and juſt Diſcernment, and the noble Deſire he hath, to contribute all in his Power to the true and real Felicity of his People, has already called from all Parts of *Europe*, near his ſacred and auguſt Perſon, a ſelect Number of learned Men, in order to make the Arts and Sciences flouriſh in his Dominions, which had been ſo long confined in a Garret, in other Countries, where they uſed to mourn the Death of their late Protector *Lewis XIV.* King of *France*.

The Schools, where the Rabbins and other Doctors of the *Jewiſh* Law, inſtruct their Youth in the *Hebrew*, explain to them the *Talmud*; teach the *Caballa*, &c. are alſo called *Academies*, as well as the *Seminaries*, where our Non-conformiſt Miniſters are educated.

A riding or fencing School, is alſo called *Academy* by our modern Authors, and *Ephebeum*, or *Gymnaſium*, by *Vitruvius* and ſome other Antients.

The Ground ſet apart in an *Academy*, for Riding, is called *Manège*, with a Pillar in the Centre, and other Pillars placed two by two at the Sides. — That for Fencing, *Salle*.

Fencing is the Art of Defence, or of uſing the Sword, to wound an Enemy, and ſhelter one's ſelf from his Attacks.

The Art of Fencing is acquired by practiſing with Foils, called in *Latin*, *Rudeſ*, whence Fencing is alſo denominated *Gladiatura Rudiaria*.

Pyrad aſſures us, that the Art of Fencing is ſo highly eſteemed in the *Eaſt Indies*, that none but Princes and Noblemen are allowed to teach it. — They wear a Badge or Cognizance on their Right Arms,

called in their Language *Eſaru*, which is put on with great Ceremony, like the Badges of our Orders of Knighthood, by the Kings themſelves.

Montaign informs us, that when he was a Youth, the Nobility all ſhunned the Reputation of being good Fencers; as ſomething too ſubtle and deſigning, and apt to corrupt virtuous Manners.

Fencing is divided into two Parts, *Simple* and *Compound*.

Simple, is that performed directly, and nimbly on the ſame Line; and is either offensive, or defensive. — The principal Object of the firſt, is, whatever may be attempted in pushing or making Paſſes from this or that Point, to the moſt uncovered Part of the Enemy. — The ſecond conſiſts in parrying and repelling the Thrufſts aimed by the Enemy.

The *Compound*, on the offensive Side, includes all the poſſible Arts and Inventions to deceive the Enemy, and make him leave that Part we have a Deſign on, bare and unguarded, upon finding we cannot come at it by Force, nor by the Agility of the ſimple Play.

The principal Means hereof are Feints, Appeals, Claiſhings, and Intanglings of Swords, half Thrufſts, &c. and in the Defensive, to puſh in Parrying.

Parrying, is the Action of defending a Man's ſelf, or of ſtaving off the Strokes offered by another. — Good Fencers puſh and parry at the ſame Time. — The *Spaniards* parry with the Poniard; the Ancients parried with their Bucklers.

Feint, is a falſe Attack, or a Shew of making a Stroke or Puſh in one Part, with Deſign to bring the Enemy to guard that Part, and leave ſome other Part unguarded, where the Stroke is really intended.

Feints are either ſingle, or double, high, or low, without, or in the whole Circle; of one, two, or three Measures.

The *ſimple Feint*, is a meer Motion of the Wriſt, without ſtirring the Foot, &c.

Guard, is an Action or Poſture proper to ſcreen the Body from the Attacks of an Enemy's Sword.

There are four general Guards of the Sword, to underſtand which, it will be neceſſary to imagine a Circle drawn on an upright Wall, and divided into four Cardinal Points, viz. Top, Bottom, Right, and Left.

Now when the Point of the Sword is directed to the bottom Point of the Circle, and conſequently the Head of the Sword tilted up to the top Point, with the Body inclining forwards; this is called *Prime*, or the *firſt Guard*. — The *ſecond Guard*, which ſome improperly call the *Third*, is when the Point of the Sword is directed to the Right, or ſecond Point of the ſame Circle, a Quadrant diſtant from the firſt; with the Fort of the Sword turned to the Right, and the Body raiſed proportionably. — *Tierce*, or the *third Guard*, is performed by directing the Sword's Point to the uppermoſt Point of the ſame Circle, diametrically oppoſite to that of *Prime*; in which Caſe the Body, Arm, and Sword, are in their natural Diſpoſition, being the Mean between the Extremes of their Motion. — *Quart*, or the *fourth Guard*, is, when the Point of the Sword is directed to the fourth Point of the Circle, deſcending to the Right, as far as one Fourth of the *Tierce*, with the external Side of the Arm, and the Flat of the Sword turned towards the Ground; and the Body out of the Line to the Right, and Fort of the Sword towards the Line to the Left. — There is alſo *Quint*, or a Kind of *fiſth Guard*, being the Return of the Point of the Sword on the Right, after tranſverſing the Circle, to the point of the *Prime*, whence it had departed; and yet, with a different Diſpoſition of the Body, Arm, and Sword.

Theſe Guards are alſo called *Figures* and *Poſtures*; and the common Centre of all their Motions, is to be in the Shoulder.

In all theſe Kinds of Guards there are high advanced, high retired, and high intermediate Guards, when diſpoſed before the upper Part of the Body, either

either with the Arm quite extended, quite withdrawn, or in a mean State.—*Mean advanced Guard*, or simply *mean Guard*, is when the Sword is disposed before the middle Part of the Body.—*Low advanced, retired, or intermediate Guards*, are those where the Arm and Sword are advanced, withdrawn, or between the two Extremes, before the lower Part of the Body.

Some will have *Prime* the principal Guard; others *Quint*; others, with better Reason, *Tierce*, because it consists of right Lines, which are easier defended than oblique ones; such as those of *Prime, Second, Quart, and Quint*.

These Sorts of *Academies*, are seldom frequented by any other but the Nobility and Gentry; to whom they seem to be indispensibly necessary, since nothing is more ridiculous than to see a Person wear a Sword, who don't know how to use it; but then, that Sword should never be drawn but for the Service of the Prince, and in Defence of one's Country; seldom to be revenged of an Affront, unless it be a flagrant one; and never to acquire the scandalous Reputation of being accounted, what the *French* call *un bon Breteur*, a good Swordsman.—That ridiculous Vanity, has caused the Ruin of a vast Number of very noble and illustrious Families in *France*, before the entire Abolition of *Duels*, by their late King *Lewis XIV.* who had obliged himself, and all his Successors, by the most solemn Oath, to be taken at their Coronation, never to forgive a *Duel*, even in the Princes, their Children. Before that prudent and salutary Regulation, *France* might have been compared to an *Amphitheatre* of Gladiators, where the *French* Noblemen were seen to take Pleasure in cutting one anothers Throats;

which was rather a Sort of Frenzy, than true Valour.

We *English*, though indued with as much Courage as any other Nation in the whole World, have seldom been guilty of those Excesses of Folly; and we seldom make any Parade of our Bravery, but in a glorious Cause; and then we do it effectually. Our *Skill* don't follow, always, all the capricious Directions of the Magnet; but when once justly directed, it strikes effectually its Poles. Therefore we have not so great a Number of *Academies* for *Fencing*, as our Neighbours, but the few we have, produce always very good Masters.

The best *Fencing* Master, for the small Sword, we have had in *England* for these twenty Years past, is one *Marin a Frenchman*, who has had the Honour to teach his Royal Highness the *Duke*, and most of our young Nobility.

Moliere seems to have had but a very indifferent Opinion of those *Academies* for *Fencing*, which he turns into Ridicule, in his Comedy of the *Bourgeois Gentilhomme*, in the Person of *Monsieur Jourdain*; intimating therein, that a Man's Courage is the best Master on those Occasions, and that *Prime, Second, Tierce, Quart, Quint, Feints, &c. &c.* are soon forgotten, when two Persons are engaged in Earnest. I'll agree with him, that an Academical Education, without Courage, is of very little Service in an Encounter; but not so, when they both meet in the same Person; since it is a general Maxim, that Nature itself is often perfected by Art. He that follows nothing but the Impetuosity of his Bravery or Valour, is always more expos'd, than one who hath that Valour directed by an Academical Education.

AGRICULTURE.

AGRICULTURE (of the Latin *Ager*, Field; and *Cultura*, of *Colo*, I till) is the Art of tilling or cultivating the Earth, in Order to render it fertile, and make it bear Plants, Trees, Fruits, &c.

EARTH and SOIL, *Solum*, are synonymous, in Agriculture, and denotes Earth or Ground, considered with Regard to the Quality of its Mould, for the Production and Growth of Vegetables.

Mr. *Bradley* reduces all *Soils* to three Heads, or Kinds, *viz. Sand, Loam, or Mother-earth, and Clay*.

Gravels, and all the open *Soils*, till we come at Loam, are of the sandy Race; and the binding Earth, from Loam down to the Stiffness of Chalk, may be ranged under the Clay Kind.

M. de la Quintinie attributes all the Difference we find in *Soils*, to the different Quality of the *Sands* mixed in them. *Soft Sands*, according to him, make a soft, gentle Earth; *Unctuous Sands*, a stiff Earth; *Coarse Sands*, a rough, untractable Earth.

SAND is also applied to dry, crumbling Earths, which, wanting any Fatness to bind them together, the Wind easily breaks into Dust, and carries them away.

In this Sense it is that Travellers tell us, the Caravans in *Africa* are frequently lost, and buried under Clouds of *Sand*, torn up by Whirlwinds; and sometimes heaped up into Mountains.—The Desarts of *Lybia* are mere Sands; and hence their Sterility.

CLAY is a soft, viscous Earth, found in various Places, and used for various Purposes, of several Kinds and Properties.

Dr. *Lister*, in the *Philosophical Transactions*, gives us a Table of twenty-two several *Clays* found in the several Counties of *England*; five whereof he calls,

Pure, i. e. such as are soft, like Butter to the Teeth, with little or no Grittiness in them, *viz. 1. Fuller's Earth*, which he distinguishes by its Colour into Yellowish, Brown, and White. 2. Boles. 3. Pale yellow Clay. 4. Cowshot Clay. 5. Dark blue Clay, or Marle. The other seventeen,

Impure; whereof eight are harsh and dusty when

dry: as, 1. Creta, or Milk-white Clay. 2. Potters pale yellow Clay. 3. Blue Potters Clay. 4. Blue Clay, wherein is found the *Astroites*. 5. Yellow Clay. 6. Fine red Clay. 7. Soft chalky blue Clay. 8. Soft chalky red Clay.

Three are stony when dry, *viz. 1. A stony red Clay. 2. A blue stony Clay. 3. A white stony Clay.*

Three are mixed with Sand or Pebbles, *viz. 1. A yellow Loam. 2. A red sandy Clay. 3. A second Species of the same Kind.*

Lastly, Three are mixed with flat or thin Sand, glittering with Mica: *viz. 1. Crouch white Clay. 2. Gray, or bluish Tobacco-pipe Clay. 3. A red Clay.*

Loam or Mother-earth, consisting of Clay with a small Admixture of Sand in it, is the Medium between the two, and includes all the intermediate Kinds.

Each of these *Soils* tend alike to Vegetation; and each has its Salts proper thereto, but in different Proportions; a Peck of Clay having twice as much Salts in it as the same Quantity of Loam; and four Times as much Sand.

Now it is found to be the Salts or Juices of the Soil, not the Earth itself, that Plants are fed and subsisted by. For in many Experiments of Vegetation, where Plants of fifteen or twenty Pounds Weight have been produced, there has been no sensible Diminution in the Weight of the Earth.

Hence at first Sight, it might seem, that Clay were the most proper, and Sand the least proper Soil to promote the Growth of Plants; which is contrary to Experience. The Reason is, that the Parts of Clay being close wrought together, do not so easily give out their Salts; nor can the tender Fibres of many Plants make their Way through it, in Search of their Food. But if its Parts be well opened, by digging, or breaking it in very small Pieces, and those Parts be kept open by a Mixture of some sharp Sand, or other like Matter, that Author adds, we shall see the

Effects of its Vigour. Sand, on the other Hand, giving its Salts readily, puts forth its Plants very early, and will make them germinate a full Month sooner than Clay; but as it is hastily, it is soon spent. The Sun's Warmth calls up all its Salts early in the Spring, and there is but little left for them to subsist long on, if the Heat continue.

Each Kind has its peculiar Plants, which will not grow in the other; but the peculiar Plants of both the other will grow in Loam, as partaking equally of the Qualities of both. Loam, then must be allowed the best and most beneficial *Soil*, where it can be had; and where it cannot, if, by a Mixture of other Earths, we can make a Compost to resemble it; we have more to expect from it, especially in Plantations of durable Trees, than from a Composition of Dung or other forcing Ingredients; which like Excess of high intemperate Food and Liquors, though they give a hasty Growth, yet make the Thing short liv'd. The Composition or *Soil* here meant, is equal Quantities of Sand and Clay well mixed.

Generally, such Composition, also called COMPOST or HOT-BED, is better than any simple *Soil*. A Mixture of two or three *Soils*, is better than any simple *Soil*, especially where the hot and dry are mixed with the cold and moist. Clay laid on Sand or Gravel, or Sand on Clay, is the better Manure.

But it is not the Nature of the *Soil* alone; but its Depth is also to be regarded, and what Soil is underneath. For the best Soil, if it be not above a Foot deep, or lie on a stiff Clay, or hard cold Stone, it is not so fertile as the leaner *Soil* of greater Depth, or lying on a warm Lime-stone, Sand or Gravel, thro' which the superfluous Moisture may descend, and not stagnate on the Clay or Stone, to chill the Roots of Plants.

Indeed, Regard is to be had to the Climate; for even in *England*, cold, moist Clays are more fruitful in the South than in the North.

Some general Rules with Respect to *Soils*, are as follow.

1st, All Land that moulders to Dust with Frost, with all Sorts of warm Lands, black Mould, yellow Clay, (if not too wet) and that turns black after Rain, are good for Corn.

2d, Lands bringing forth large Trees and Weeds, Black thorns, Thistles, rank Grass, &c. generally prove fruitful.

3d, Strawberries, Betony, Thyme, &c. give Indication to Wood; and Camomile to a Mould disposed for Corn.

4th, All Land that binds after Frost and Rain, that turns white and full of Worms, that is extremely moist, bears Holly, Yew, Box, Broom, Heath, Moss, &c. is of a cold Temperature.

5th, Black, dun and yellow Sand, and hot stony Gravel, are generally unfruitful.

COMPOST, is a Compound or Mixture of Earths, Dungs, &c. applied by Way of Manure, for the meliorating and improving of *Soils*, and assisting the natural Earth in the Work of Vegetation.

HOT BED, a Piece of Earth or Soil plentifully enriched with Manure, and defended from cold Winds, &c. to forward the Growth of Plants, and force Vegetation, when the Season or Climate of itself is not warm enough.

By Means of Hot-Beds skilfully managed, we can so nearly imitate the Temperature of other Climates, that Seeds of Plants brought from any Country between the Tropics, may be made to flourish even under the Poles.

Heat and Humidity being the great Instruments of Vegetation, to promote the Growth of any Plants, these must be duly proportioned, so as neither to exceed nor come short of the Bounds Nature has allotted for it. Too much Heat we find rather scorches a Plant than makes it grow; and too much Moisture frequently chills it, unless quickly exhaled from the Roots. With us a moderate Heat is found the most eligible; such as is raised by the Ferment of wet Straw

and Horse-litter, which from the Earth lying thereon, will send forth for some Time a gentle Steam, impregnated with vegetable Salts.

The usual Way of making *Hot-Beds*, is of Horse-litter and Grass mixed together, and left on an Heap for eight or ten Days to putrify; and then removed into a Bed and covered up with Glasses, or Frames. —Others chuse to take Horse-dung a Month or six Weeks old, and make a Seed Bed of it about four foot high, and cover it up with Straw a Foot thick, which is to be removed in three or four Days, and its Place supplied either with Cows-dung, or the last Year's Ridges.

The Process of ordering a good serviceable *Hot-Bed*, for the customary raising of Colliflowers, Cucumbers, Melons, Radishes, and other tender Plants and Flowers, in *January* or *February*, is directed by Mr. Mortimer in Manner following.

Provide a warm Place defended from all the Winds, by being inclosed by a Pale or Hedge made of Reeds or Straw, about six or seven Foot high, of such Distance or Capacity as Occasion requires. —Within this Inclosure raise a Bed two or three Foot high, and three Foot over, of fresh Horse-dung, about six or eight Days old; then tread it down very hard on the Top, make it level, and if you think fit, edge it round with Boards or Bricks, laying fine rich Mould about three or four Inches thick on it, when the extream Heat of the Bed is over, which you may perceive by thrusting in your Finger; plant your Seed at Pleasure, and set your Forks four or five Inches above the Bed, to support a Frame made of Sticks, and covered with Straw or Bals Matts, in order to secure the Seeds and Plants from Cold and Wet; only the Covering may be opened in a warm Day, for an Hour before Noon, and an Hour after. —But take Care to earth up your Plants as they shoot in Height; and when able to bear the Cold, they may be transplanted.

In *Holland* they make Use of *Hot-Beds* made of Sand, which are not so apt to raise unwholesome Damps as those of Horse-dung. —The *Dutch* likewise make *Hot-Beds* of Tanners Bark, which when once rightly prepared will maintain an equal Heat for six Months.

Bradley, with very good Reason proposes, a Thermometer to be used to regulate the Heat of *Hot-Beds*, for Plants that are either to be brought up in a colder Season, or a colder Climate than what they naturally require; you are to take the Height at which the Thermometer stands in their proper Season or Clime, as a Standard; and by applying the Thermometer to the *Hot-Bed*, judge whether the Heat is to be intended or remitted. —Thus a *Hot-Bed* for Cucumbers must be kept, to raise the Spirit in the Glass, to the same Height as the natural Temperature of the Weather will raise it to about the latter End of *May* and *June*, when Cucumbers will grow abroad without any artificial Heat or Shelter.

The principal and most general Operations in *Agriculture*, are manuring, ploughing, fallowing, sowing, harrowing; as also reaping, mowing, &c.

MANURING, is the Application of a Matter proper for meliorating the Soil and rendering it more fertile.

The Matters used for *Manure* are various in various Countries; the most ordinary are Dung, Lime and Marle.

MARLE, (from the antient *Celtic*, *Marga*, called afterwards *Margila*) is a Kind of dry, soft, fossil Earth, harsh to the Touch; used to be cast on the Land to make it more fruitful.

There are several Sorts of *Marle*, of different Colours, and Qualities, too much *Marle* thrown on the Earth is found to burn it.

In some Parts of *Ireland* they use Sea Shells, of those of Cockles, Periwinkles, &c. which are found well to agree with boggy, heathy, clayey, wet or stiff Land; as they seem to give it a Kind of Ferment, as Barley does to Bread, opening and loosening the Clods, and by

by that Means making Way for the Roots to penetrate, and the Moisture to enter into the Fibres of the Roots.

This Kind of *Manure* continues a long Time e're its Effects are exhausted; whereas Lime, &c. spend themselves at once. The Shells being hard, melt away very slowly, so that the Operation need not be repeated for twenty or thirty Years.

In the West of *England* they *manure* their Land with a brackish Sea-sand; which Dr. *Berry* observes, quickens dead Land: So that what would otherwise be the barrenest Part of that Country, is now the richest. The Sea Salt, he observes, is too lusty and active in itself, and that it does best when mingled with Lime. *Glauber* orders the Mixture to be made up and burnt, like Bricks, and then applied.

In some Countries they burn the Surface of their heathy Ground, instead of manuring it; which others think but ill Husbandry, inasmuch as it impoverishes it; and by destroying the Sap of the Earth, and Roots of the Grass, and other Vegetables, render it useless for several Years after the third, when it is ploughed.

Dr. *Jackson* observes, that all the Ground about *Nantwich*, where Salt or Brine is spilt, is, when dug up, an excellent *Manure* for grazing Ground; and even Bricks, thoroughly tinged with it, dissolve and fertilize Land very considerably.

Dr. *Beal* says, it is a common Observation of Gardeners and skilful Husbandmen, that Frost and Snow improve and fertilize the Land more speedily and more effectually, than the Influence and Warmth of the Sun.

Dr. *Lister* tells us, that in some Parts of the North-riding of *Yorkshire*, the Soil is sandy, and the People *manure* it with Clay. The Soil with any other *Manure*, bears nothing but Rye; but with Clay, bears Oats, Barley, &c. This Clay-manuring, will, by certain Experience, last forty-five Years in the Ground, e're it need be repeated.—The Bogs in *Ireland* are said to be best improved by sandy, or other gravelly *Manure*.

Ploughing, is an Operation performed with the Plough.

Plough, or Plow, is a popular Machine for the breaking up of Ground; consisting of a Train or Carriage, with two large Irons, the one pointed, the other edged, serving to cut, and open the Ground, and draw Furrows therein.

The Parts of the Plough are, the *Plough-Beam*, the *Handle*, *Tail*, *Stilts*, *Halet* or *Staves*, *Neck* or *Share-beam*, *Earth-board*, *Mould-board*, *Breast-board*, *Furrow-board*, *Shield-board*, &c. the *Sheath*, *Share-iron*, *Coulter*, *Plough-pin*, and *Collar-links*, *Plough-pillow*, and *Bolster*, and sometimes *Wheels*.

The Structure and Contrivance of the Plough is various, in various Kinds of Grounds: A particular Description of all would be endless.—The most usual are the

Double-wheeled Plough, used throughout *Hertfordshire*, &c.—This is apparently one of the best, strongest, and of easiest Draught, of any; and suits all Kinds of Lands, except miry Clays in Winter; which are apt to clog the Wheels, which are about eighteen or twenty Inches high, and the Furrow-wheel sometimes larger than the other.

Lincolnshire Plough is singular in its Shape, and very good for marsh or fenny Lands, subject to Weeds and Sedges, but free from Stones; by Reason of the Coulter, and the Largeness of its Share, which is often a Foot broad, and very sharp.

Suffex *Single-wheel* Plough, is of a clumsy Make, very wide in the Breech; so that the Draught of it must be very hard.—It's chiefly remarkable for its Shape.

Caxton or *Trenching* Plough, invented to cut Drains about *Caxton* in *Cambridgeshire*, in stiff, miry Clay Grounds.—It is larger than ordinary, and has two Coulters, one before the other; which bending inwards, cut each Side of the Trench.—The Mould-

board is three Times the usual Length, to cast the Turf a great Way off from the Trench.

It cuts the Trench a foot wide at Bottom, a Foot and Half at Top, and a Foot deep; and is drawn with twenty Horses.

Dray Plough is the most common.—It is made without either Wheel or Foot; of an easy Draught, best in Winter for miry Clays, where the Land is soft.

Spanish Plough, varies much in its Make from our common Ploughs. It is a Kind of a Semicircle, pitched on one End, with the convex Side turned to the Ploughman, and the concave Side, a little turned to the Horse. Its Tail is in a right Line with the Share.

With this Plough, and one Horse, the *Spaniards* plough two or three Acres of their light Ground in a Day.

Colchester Plough, is a fine Light-wheel Plough, with which, two Horses will cut up two Acres of their light Land in a Day.—It is peculiar for its Iron Earth-board made rounding, which turns the Turf better than any other Plough yet invented.

One-wheel Plough, may be used in almost any Kind of Ground, being lighter and nimbler than any other wheel Plough.

Double Plough, is this; there is one Plough fixed to the Side of another; so that by Means of four Horses and two Men, a double Furrow is ploughed, the one by the Side of the other.

Add to these another Kind of *Double* Plough, whereby two Furrows are ploughed at once, one under another, by which the Earth is stirred up twelve or fourteen Inches Depth, which is of great Benefit.

Ploughing, is principally either that of *Layes*, or of *Fallows*.

Fallowing, is to prepare Land, by ploughing, long before it be ploughed for Seed. To do this twice, is to *Twifallow*, and thrice, to *Trifallow*, &c.

The first is as soon as the Husbandman has done sowing his Corn, and this to be very shallow, well turned, and clapped close together.—The second is in *June*, when they go the full Depth.—The third, about the Beginning of *August*.—If it rise full of Clods, they harrow it down; but soon strick-size, or plough it up again into Ridges.

In *Staffordshire*, besides the three Summer Fallows, they usually give their Land a Winter *Fallowing*. *Pliny* commends the ploughing of Lands four Times, and so does *Virgil*.

*Illa seges demum votis respondet avari
Agricolæ, bis quæ solem, bis frigora sensit.*

Georg. lib. 1.

This is an ancient Piece of Husbandry; *Xenophon*, *Pindar*, and *Virgil* recommend it, witness these Verses of *Virgil*.

*Alternis idem tonsas cessare novales,
Et segnem patiére situ durefcere campum.*

Georg. lib. 1.

Sowing, is the Art of shedding Seed, particularly that of Vegetables.

As soon as the Seed is ripe, Dr. *Crew* observes, Nature takes several Methods for its being duly sown, not only by the opening of the Uterus, but in the Make of the Seed itself.—Thus, the Seeds of many Plants, which affect a peculiar Soil or Seat, as Arum, Poppy, &c. are heavy, and small enough without farther Care to fall directly down to the Ground.

Others that are large, and light enough to be exposed to the Wind, are often furnished with one or more Hooks, to stay them from straying too far from their proper Place, thus the Seeds of *Avens* having a single Hook; those of *Agrimony*, and *Goose-grass*, many; both the former loving a warm Bank, and the last, a Hedge for its Support.

On the contrary, many Seeds are furnish'd with Wings,

Wings, or Feathers, partly with the Help of the Wind to carry them, when ripe, off the Plant, as those of Ash, &c. and partly to enable them to make their Flight more or less Abroad, that they may not by falling together, come up too thick; and that if one should miss a good Bed, another may hit. — So the Kernels of Pines have Wings, though short ones, whereby they do not fly in the Air but only flutter on the Ground, but those of Typa, Dandelion, and most of the pappous Kind, have numerous long Feathers, by which they are wafted every way.

Others are sown by being laid in springy elastick Cases, which, when they crack and burst, dart their Seed at convenient Distances: Thus, Wood-sorrel having a running Root, Nature sees fit to sow the Seed at some Distance, the doing of which is effected by a white, sturdy, tendinous Cover, which beginning to dry, bursts open on one side in an Instant, and is violently turned inside outwards. The Seed of Heart-tongue, and coddled Arsmart, is flung or shot away, by Means of a Spring, wound or girt round the Seed-case. When the Spring is become stark and tense enough, it suddenly breaks the Case into two Halves, like little Cups, and so flings the Seed.

Divers notable Means of Semination are observed by other Authors: A Quantity of Fern-seed, Mr. Ray tells us, laid in a Lump, on a Paper, the seminal Vesiculae are heard to crackle, burst, and, by a Microscope, the Seeds are seen to be projected to a considerable Distance from each other. — Dr. Sloane observes, that the *Gentianella flore caerulea*, or Spirit-leaf, requiring wet Weather to be sown in, as soon as the least Drop of Rain touches the End of the Seed-vessels, with a smart Noise, and sudden Leap, it opens itself, and with a Spring scatters its Seed.

The Plants of the Cardamine-family, throw their Cods open, and dart out their Seed upon a slight Touch of the Hand. Nay, Mr. Ray adds, that the Pods of the Cardamine impatient not only burst upon the slightest Touch, but even by an Approach of the Hand to touch them, without any real Contact.

Other Plants sow their Seeds by inviting Birds, by their agreeable Taste and Smell, to feed of them, swallow them, and carry them about; thereby also fertilizing them, by passing through their Bodies. — In such Manner are Nutmegs and Mistletoe, sown and propagated.

SEED *Semen*, is a Matter prepared by Nature, for the Reproduction, and Conservation of the Species, both in Men, Animals, and Plants.

Mr. Bradley observes, that the Seeds of Plants in Gardening and Agriculture (those meant here) though exceedingly good, will degenerate from the Mother-plant, if they be sown on the same Ground, whence they were gathered; so that there is great Necessity for a yearly Change of Seeds of Forrest-trees, as Acorns, Mastis, &c. If the Place be too cold to sow them when gathered in August, they may be kept barrelled, or potted up, in moist Sand or Earth, *stratum super stratum*, during the Winter, at the End of which they are found sprouted, and if gently sown, will be as forward, as if sown in Autumn; beside their missing the Vermin to which the Winter Seed is much exposed.

The Seed is not to be chosen from the most fruitful Trees, so much as from the most solid and fair, nor are we to covet the largest Acorns, but the most weighty, clean and bright; porous, insipid, mild Sorts of Seeds, are to be sown as soon as ripe; hot, bitter Seeds to be kept a Year before sown.

The Shape and Weight of Seeds, direct how they are to be set: Most of them, when they fall, lie on one side, with the small End towards the Earth, which shews that Posture to be best to set any Stone or Nut in: If they be heavy, sow them the deeper. Acorns, Peaches, &c. to be sown two or three Inches deep.

HARROWING is to break the Clods of Earth after Ploughing.

HARROW is a Drag made in a Square Form for that Operation.

It consists of five Parts; 1. The Harrow Bulls, which are the Holes where the Nails go in; 2. The Slots, which are the cross Pins; 3. The Harrow Tines, Pins, or Rushes, which are iron Nails; 4. The Hook, being that which fastens the Horse to them; 5. The Couples, when two Harrows are tied together.

To the Operation of Agriculture do also belong the Management of the Productions of different Countries, as Hops, Hemp, Vines, Tobacco, Saffron, Liquorice, Woad, &c.

Hop, *Lupulus*, is a Plant of the reptile Kind; whose Flower is a principal Ingredient in Beer, and other Malt-liquors.

The Hop creeps like Snake-weed, unless it find Pales or Shrubs to hang to; or unless they who cultivate it, plant Poles for the Purpose. — Its Stem is long, flexible, rough, and hairy. — Its Leaf indented like that of the Vine, and covered with a Kind of a prickly Down like that of the Cucumber. Its Flowers are of a greenish Yellow, resembling, both as to the Form and Size, those of the female Elm; and grow in a Kind of Bunch or Cluster. In this Flower is a blackish bitter Grain contained, which is the Seed of the Hop.

In the Spring Time, while the Bud is yet tender, the Tops of the Plant being cut off, and boiled, are eat like Asparagus; and found effectual to loosen the Body; the Heads and Tendrils are good to purify the Blood in Scorbutick and most cutaneous Diseases: Decoctions of the Flowers and Syrups thereof are of Use against pestilential Fevers: Juleps and Apozems are also prepared with Hops for hypochondriacal and hysterical Affections, and to promote the Menfes.

The Propagation and Culture of Hops, being a Point of some Nicety, as well as great Advantage, we shall lay down a little System thereof. — It is certain there is nothing in all the rural Employments, that, under prudent Management, turns to more Account; very large Estates have been raised by this Commodity in a few Years past. — *Switzer* tells us, he has known Ground yield 30 l. per Annum, per Acre, planted therewith: To say nothing of the great Number of Poor that are employed therein, viz. in the planting, soiling, digging, houghing, poling, tying, picking, &c.

Culture of Hops and Hop Gardens. — Hops are of diverse Kinds: *Mortimer* reckons Four, viz. the wild garlick Hop, which is not worth Propagating; the long and square garlick Hop, which, though valuable, yet on account of the Redness towards the Stalk, does not bear the best Price; the long white Hop, which is the most beautiful and fertile; and the oval Hop.

Another Author distinguishes the Hops to be cultivated, into the white and grey Kinds; the latter being a large square Hop, more hardy, and bearing a plentiful Crop than the former; though it does not ripen so early.

For the Soil of Hops. — There are scarce any but may serve, except stony, rocky, and stiff Clay Ground: the best, however, is that which is light, deep, and rich; which will be the better if Sand be mixed with it: A black Garden Mould is also excellent. If the Ground be cold, stiff, and sour, the best Improvement is to burn-beat it. *Mortimer* adds, that in Kent, where they esteem new Land best for Hops, they plant their Hop Gardens with Cherry-trees, and Apple-trees, at a good Distance; that when the Land is past the best for Hops (which happens in about ten Years) the Cherry-trees may begin to bear; and thirty Years after, when the Cherry-trees are spent, the Apple-trees may be in Perfection.

For the planting of Hops. — The Ground is first to be prepared by Tilling it the beginning of Winter, either with a Plough or Spade. In October, (and sometimes, though rarely, in March) they proceed to plant; marking out the Places where each Hillock or little Plantation is to be, some plant in Squares, Chequer-wise, which is the most convenient Form, where they intend, in the Course of the Tillage, to plough

plough with Horses between the Hills : But the best Form for the Hop, as well as the most pleasing to the Eye, is the Quincunx.

If the Ground be poor, or stiff, it is necessary some good Mould, or else a Compost of Manure and Earth, be laid in Holes a Foot square, in the several Places where the Hills are to be. — The Distance of the Hills in dry hot Ground may be six Foot ; but in moist and rich Ground, subject to bear large Hops, eight or nine.

For planting, the largest Sets are to be chosen, eight or ten Inches long, having each three or four Joints, these to be set in Holes, made for the Purpose, one at each Corner of a Hole, and a fifth in the middle, raising the Earth two or three Inches about.

For the dressing of Hops. — If the Hop-ground be old, and worn out of Heart, they find it convenient to dig about them, towards the beginning of each Winter, and take away a Quantity of the old Earth ; its Place to be supplied with what is fatter and fresher. — If the Hops be in good Heart, manuring and pruning is most adviseable. In order to this they pull down the Hills, and undermine all about, till they come near the principal Roots. This done taking off the Earth from the Roots, they find by the Colour, &c. which are new Shoots, and which old ones ; and cut off all the new ones. — When the Roots are thus dressed, the new Mould or Manure to be applied.

For the Poling. — The Time is when the Hops begin to appear above Ground ; the Number and Dimensions of the Poles to be adjusted to the Distance of the Hills, the Nature of the Soil and Strength of the Hop. — To prevent *Houpling*, the Poles are to be made to lean outwards ; and particularly towards the South, to receive more of the Sun's Beams ; it being Matter of Observation, that a leaning Pole bears more Hops than an upright one.

As to tying. — When the Hops are got two or three Foot above Ground, the next Business is to conduct and tie them to such Poles as are empty, and at a proper Distance from them. — They are to be tied with withered Rushes, or woollen Yarn ; but not so close as to hinder their climbing up the Poles : Two, or three Strings may suffice for a Pole. This Operation is to be attended to in *April* and *May*.

About Midsummer, when they cease to run in Length, and begin to branch, such of them as are not yet got up to the Tops of the Poles, should have their Heads nipped off, or else be diverted from the Pole, that they may branch the better ; which is more for the Increase of the Hop, than its extending in Length.

Sometimes in *May*, after Rain, the Hills are to be made up with a Hoe, or Spade, or by ploughing ; which will be a Means to destroy the Weeds : And it is necessary, if the Spring or Summer prove dry, to water them twice or thrice in a Season.

Hops blow towards the latter End of *July* : And the forward ones are ripe by the Close of *August*. — Their Ripeness is discover'd by their fragrant Scent, their changing of Colour, being easily pulled, and by the brownish Colour of the Seed.

Hops are to be gathered, when they look a little brownish, and that without Delay ; the most expeditious Way is, to make a Frame with four short Poles or Sticks, laid on four Forks driven into the Ground, of such Breadth, as to contain either the Hair-cloth of your Kiln, or a Blanket tacked round about the Edges. — On this Device, the Poles with the Hops on them, may be laid, being either supported by Forks, or the Edges of the Frame ; at each Side whereof the Pickers may stand, and pick the Hops into it. — When the Blanket or Hair-cloth is full, untack it, carry it away, and place another, or the same emptied, in the same Frame again ; and this Frame may be daily removed, with little Trouble, to some new Place of the Garden near the Work.

Hops must not be gathered while wet ; but if the Dew be on them, the Pole may be shaken, and they

will dry the sooner ; if they be over Ripe they will be apt to shed their Seed, wherein consists their chief Strength ; neither will they look so Green, but somewhat Brown, which much lessens their Value ; though some let them stand as long as they can ; because they waste less in their dropping ; for four Pounds of undried Hops, thorough Ripe, will make one of dry ; whereas five Pounds of those scarcely Ripe, yet in their Prime, make but one. So that it is judged the Proprietors get more in the thorough ripe Hop by the Weight than they lose in the Colour.

As soon as the Hops are picked, they must be dried ; some, especially the *Flemings* and *Hollanders*, make Use of an Oost or Kiln for this Purpose, others dry them on the ordinary Malt-kiln in an Hair-cloth : But the best Way, is to make a Bed of flat Ledges, about an Inch thick, and two or three Inches broad, sawn, and laid one across the other Chequer-wise, the flat way ; the Distances about three Inches, or the like ; the Ledges so entered, are put into another that the Floor may be even and smooth : This Bed may rest on two or three Joists set edgewise, to support it from sinking ; then cover it with large double Tin Plates sodered together at each Joint ; and so order the Ledges before they are laid, that the Joints of the Tin may always lie over the Middle of a Ledge ; and when the Bed is wholly covered with Tin, fit Boards about the Edges of the Kiln to keep up the Hops, only let the one Side be to remove, that the Hops may be shoved off as before. The Hops may be turned on this Tin Bed or Floor with great Safety and small Expence of Fuel ; beside, that any Manner of Fuel will serve for this Purpose as well as Charcoal, the Smoke not passing through the Hops : But it must not be forgot to make Conveyances for it at the several Corners and Sides of the Kiln.

The turning of Hops, after the easiest and most secure Manner, is found to be not only a Waste and Injury to the Hop, but also an Expence of Fuel and Time ; yet it may be prevented, in Case the upper Bed, whereon the Hops lie, have a Cover that may be let down and raised at Pleasure ; which Cover may be tinned over, by nailing single Tin Plates to the Face of it ; that when the Hops begin to dry, and are ready to be burnt, you may let down this Cover within a Foot and less of the Hops, which will reflect the Heat upon them, that the uppermost Hop, will be as soon dry as the lower, and every Hop equally dried.

The Method of Bagging Hops, (after they have lain a Month more to cool and toughen) is to make a round or square Hole in an upper Floor, big enough for a Man with Ease to go up and down, and turn and wind in it ; then tack a Hoop about the Mouth of the Bag fast with Packthread, that it may bear the Weight of the Hops when full, and of the Man that treads them ; that done let the Bag down through the Hole ; and the Hoop will rest above, so as to keep the Bag from sliding wholly through ; into this Bag cast a few Hops, and before you go in to Tread, let an Handful of Hops be tied at each lower Corner with a Piece of Packthread, to make, as it were a Tassel, whereby the Bag, when full, may be conveniently lifted or removed ; then go into the Bag, and tread the Hops on every Side, another still casting in as fast as you require, till it be full ; when it is well trodden and filled, let the Bag down, by unripping the Loop, and close the Mouth of the Bag, filling the two upper Corners as you did the lower : This Bag, if well packed and dried, will keep several Years in a dry Place ; only Care must be taken, that Mice do not spoil or waste the Hops ; not that they will eat them, but make their Nests therein.

Hemp, by Naturalists called *Cannabis*, bears a near Analogy to Flax, *Linum* ; both in Respect of Form, Culture and Use.

The Plant is Annual ; that is, must be sown afresh every Year. — It rises quick, into a tall slender Sort of Shrub, whose Stem however is hollow, and big enough to be char'd, and thus used in the Composition

tion of Gunpowder.—Its Leaves arise by fives or sixes, from the same Pedicle, and are a little jagged; yielding a strong Smell, which affects the Head.—Its Flowers grow Grape-wise, opposite to each other, in Manner of St. *Andrew's* Cross; each consisting of five yellowish Stamina, encompassed with a like Number of Petala, purple without, and white within.—Its Fruit or Seed is small and round, filled with a white solid Pulp; and grows on the Top of the Stem; having its Pedicles distinct from those of the Flowers.—Lastly, its Bark is a Tissue of Fibres, joined together by a soft Matter, which easily rots it.

Hemp is of two Kinds; Male, properly called *Karl*; and Female, or *fmble*.—It is the Male alone that produces Seed, to perpetuate the Kind; from the Seed of the Male, arises both Male and Female.

It does not appear, that the Antients were acquainted with the Use of *Hemp*, in Respect of the Thread it affords. *Pliny*, who speaks of the Plant in his *Natural History*, l. XX. c. 23. says not a Word of it; contenting himself with extolling the Virtues of its Stem, Leaves, and Roots. In Effect, what some Writers of the *Roman* Antiquities remark, viz. that the *Hemp* necessary for the Use of War, was all stirred up in two Cities of the Western Empire, viz. at *Ravenna*, and *Vienna*, under two Procurators, called *Procuratores linificii*; must be understood of Flax.

The Seed is said to have the Faculty of abating venereal Desires; and its Decoction in Milk, is recommended against the Jaundice, &c.—The Leaves are held good against Burns, and the Juice thereof against Deafness.—The Powder or Flower, mix'd with any ordinary Liquor, is said to turn those who drink thereof, stupid.

The Culture and Management of *Hemp*, makes a considerable Article in *Agriculture*; there being diverse Operations required therein, as pulling, watering, beating, swinging, &c.

The Plant is sown in *May*, in a warm, sandy, rich Soil; and is itself sufficient to destroy Weeds on any Ground.—About *Lammas* they begin to gather it; the Light or Female, being first ripe.

The Marks of its Maturity, are its Leaves turning yellow, and the Stalks white.

The Way of gathering, is to pull it up by the Roots; after which, they bind it up in Handfulls or Bundles. The Male, they let stand eight or ten Days in the Air, that the Seed may dry or ripen; after which they cut off the Heads, and beat or thrash them, to get out the Seed.—They also beat the Female, to get out a thick, fetid Sort of Dust, contained therein.

This done, they proceed to *water* or *rate* it, by laying it five or six Days in a Pool, or other stagnant Water, to rot the Bark. A Stream, or running Water, would do the Business much better; but that it infects the Water, and gives it a Quality very pernicious to the Health; for which Reason it is forbid to rate it in Waters used for domestick Purposes.

When rotted, and taken out again, they dry it; then *break* or beat out the dry Bun, or Hex, which is the woody Part of the Stem, from the Rind or Bark which covers it, by crushing it in a toothed or nicked Instrument, called a *Brake*, beginning with the Root End.

When the Bun is sufficiently broke, and hangs by small Shivers, they *swingle* or beat them out, with a Piece of Wood edged for that Purpose.

—Note, the *Karl Hemp*, they sometimes break with the Fingers, and strip off the Rind, without the Help of the *Brake* or *Swingle*.

The next Thing is to beat the *Hemp*; which is done either on a Block, or in a Trough, with a Hammer, or with Beetles; till it feel sufficiently soft and pliable.—It remains now to be *beckled*, or passed thro' divers toothed Instruments, not unlike the Wool-dressers Combs, of different Fineness; this separating the shorter Tow from it; the rest is fit to be spun, wove, &c. for Thread, Cloth, Cordage, or the like.

FLAX or *Line*, *Linum*, is a Plant with a slender, hollow Stem, usually about two Foot high; whose Bark consists of Fibres, or Threads, much like those of *Hemp*; which being dressed and worked in due Manner, makes that noble Commodity Linen-cloth.

Flax thrives best in a Soil that has long lain fallow. To bear *Flax*, it must be well ploughed, laid flat or even, and the Seed sown thick, in a warm Season, about the Middle of *March*, or Beginning of *April*. The best Seed is that brought from the East; which, though dear, repays the Charges with Abundance. One Sowing, will produce two or three Crops, before it need be renewed.

Flax, pulled up in the Bloom, proves whiter and stronger, than if left standing till the Seed is ripe; but then the Seed is lost.

The Preparations *Flax* must undergo, to fit it for Spinning, are pulling, drying, and twingling.

The Seed of *Flax*, called *Linseed*, has several considerable Properties. It enters the Composition of divers Medicines, and yields an Oil by Expression, which has most of the Properties of Nut-oil; and which is frequently used, in Defect thereof, in Painting, to burn in Lamps, &c. That drawn cold, is reputed good in divers Diseases.

VINE, *vitis*, is a noble Plant or Shrub, of the reptile Kind; famous for its Fruit, or Grapes, and for the Liquor they afford.

The Kinds of *Vines* are almost infinite; denominated either from the Soil, and Place where they grow; as the *Bourguignon*, *Bourdela*, *Italian*, *Mantua Vine*, &c. or from the Form, Colour, Taste, &c. of their Grapes; as the *Acorn*, *Apricot*, *Damask*, *Birds-bill*, *Muscadine*, &c. *Vine*.

Our Gardeners find that *Vines* are capable of being cultivated in *England*, so as to produce large Quantities of Grapes, and those ripened to such a Degree, as may afford a good substantial vinous Juice.—Witness the Vineyards in *Somersetshire*, particularly that famous one at *Bath*.

In Effect, it does not seem so much owing to the Inclemency of our *English* Air, that our Grapes are generally inferiour to those of *France*, &c. as to the Want of a just Culture.

Those fitted for the *English* Climate, Mr. *Mortimer* finds to be the small, black Grape, the white Muscadine, Parsley-grape, Muscadilla, white and red Frontigniac.—Mr. *Bradley* recommends the *July* Grape, the early sweet Water Grape, lately brought from the *Canaries*; the *Arbois*, or *French* sweet Water Grape: All which, if well managed, and the Weather favourable, are ripe by the Middle of *August*.—He also recommends the *Claret* and *Burgundy* Grapes.

The Spot of Ground planted with *Vines*, is called *VINEYARD*, *Vinetum*, in *French*, *Vignoble*.

The best Situation of a *Vineyard*, is on the Declivity of a Hill, lying to the South.

The best Soil for *Vines*, according to *Mortimer*, is the hottest Gravel, Sand, or dry rocky Ground, provided it be well watered, and shaded.—At first planting, Mr. *Bradley* recommends chalky Hills as proper for *Vines*.

To amend a Soil that wants those Qualities, it is good to throw in the Rubbish of old Buildings, well mixed with twice as much Earth, and sifted about the Roots of the *Vines*.

The *Vine* is propagated by Slips, Layers, or Sucklers, planted in a Nursery, and thence transplanted, about *February*, into the *Vineyard*.

The *Vines* are to be planted in Lines, running North and South, five or six Foot apart; only two *Vines* in each Hole.—The *September* following, the Shoots of that Summer to be pruned, shorter, according to their Strength; and the Summer following, the strongest will begin to shew a little Fruit.—They are now to be supported with Stakes, &c. so as they may run about a Foot above Ground: The higher they run, the less Danger they are in of being

ing spoiled with Wet; but the lower, the sweeter Grapes, and the stronger Wine.

If notwithstanding due Pruning, they do not seem inclinable to bear large Bunches, the Ground to be helped by a Mixture of Rubbish of some old Building, with Sea-coal Ashes, or drift Sand.—Thus managed, a *Vineyard*, in five or six Years, will produce good Store of Grapes.

The celebrated *Vineyard* at *Bath*, containing about six Acres of Ground, planted with white Muscadine, and black Cluster Grapes, Mr. *Bradley* assures us, by such Management, some Years ago, yielded sixty Hogsheads of Wine at a Vintage: though in the Year 1721, it only yielded three Hogsheads.

The same Author mentions a little *Vineyard* of a private Person at *Rotherhithe*; which, tho' only consisting of 100 Vines, and some of them only of the second Years Growth, yielded, at a Vintage, 95 Gallons of Wine, which he adds, had the true *Burgundy* Flavour, as being made from that Sort of Grape; and exceeded any made from any *Vineyard* on this Side *Paris*.

From the Fruit of the Vine, is drawn a Liquor called WINE, the *Method of making and fining*, which, in the Southern Parts of *France*, is, for red Wines, to tread, or squeeze the Grapes between the Hands, and to let the whole stand, Juice and Husks, till the Tincture be to their Liking; after which they press it.—But for white Wines, they press the Grapes immediately.

When pressed they tun the Must, and stop up the Vessel; only leaving the Depth of half a Foot or more empty, to give Room for it to work.—At ten Days End, they fill this Space with some other proper Wine, that will not provoke it to work again.—This they repeat from Time to Time; new Wine spending itself a little, e're it comes to Perfection.

About *Paris*, and the Northern Parts of *France*, they let their Murk and Must stand two Days and Nights, for white Wines, and at least a Week for claret Wines, e're they tun it.—While it continues working, it is kept as warm as possible.

Some upon stopping it up for good and all, roll the Cask about the Cellar, to mix the Liquor with the Lees; and after settling a few Days, rack it off, with great Improvement.

To fine it down, they put Shavings of green Beech into the Vessel; having first taken off all the Rind, and boiled them an Hour in Water, to extract their Rankness; and afterwards dried them in the Sun, or an Oven; a Bushel of these serve for a Tun of Wine. These put the Liquor in a gentle Working, and purify it in twenty-four Hours. These also give it an agreeable Flavour.—The same Chips being washed serve again and again, till almost consumed.

Some sweeten their Wines with Raisins of the Sun, trod in the Vat with the Grapes, having been first plumped by boiling; others, by boiling Half the Must, scumming it and tuning it up hot with the other.

For *English Wine*, the Method recommended by Mr. *Mortimer*, is, first, to gather the Grapes when very dry, to pick them from the Stalks, then to press them, and let the Juice stand twenty-four Hours in the Vat, covered. Afterwards, to draw it off from the gross Lees, and then put it up in a Cask, and to add a Pint, or Quart, of strong red, or white Port, to every Gallon of Juice; and let the whole work: bunging it up close, and letting it stand till January; then bottle in dry Weather.

By this Method, he assures us, he has made *English Wine*, as good as any the best and purest Wine, drank either in *Paris*, or *Champaigne*.

Mr. *Bradley* chuses to have the Liquor when pressed, stand with the Husks, Stalks and all, in the Vat, to ferment, for fifteen Days.

He adds, that, according as the Vines have been managed, the Wine will be stronger, or weaker.—Those *ex. gr.* which run at Liberty up high Trees,

and are never pruned, make the smallest Wines: Those kept tied to the Stakes, about four Feet high, and which have their Branches duly pruned, stronger Wines: And those nearest the Ground, the strongest.

The Force of fermenting Wine is very great, being able, if close stopped up, to burst through the strongest Cask.—The readiest and only Way to stop or abate the Fermentation, is by the Fume of burning Sulphur.

Add, that when Wine already made, is upon the Fret, or, by any Alteration in the Air, begins to ferment again; the Way used by the Vintners and Wine Coopers to save it, is by the Flame of common Sulphur, or a lighted Match dipped in it; which held under a Cask, just ready to burst its Hoops, calms its Fury, and makes it immediately subside.

The Goodness of Wine consists in its being neat, dry, fine, bright, and brisk, without any Taste of the Soil, of a clean, steady Colour; having a Strength, without being heady; a Body without being sour; and keeping without being hard, or eager.

Wine being a Liquor, mostly of foreign Produce; the divers Names, Forms, Kinds, Distinctions, &c. thereof, are borrowed from the Countries where it is produced; the Principal whereof, at this Day, is *France*: To Wines of which Country, a good Part of what we have to say of this noble Liquor, will more immediately belong.

Wine, in *France*, is distinguished from the several Degrees and Steps of its Preparation, into,

Mere-goutte, Mother-drop; which is the Virgin Wine, or Liquor in the Vat, after the Grapes have been trodden, or stamped.

Pressed Wine, *Vin de pressurage*, which is that squeezed with a Press out of the Grapes half bruised by the treading.

The Husks left of the Grapes, are called *Rape*, Murk, or Mark; by throwing Water upon which, and pressing them a-fresh, they make a Liquor for Servants Use, answerable to our Cyder-kin, and called *Boisson*; which is of some Use in Medicine, in the Cure of Disorders, occasioned by viscid Humours.

Sweet Wine, *Vin doux*, is that which has not yet worked or fermented.

Bouru, that which has been prevented working, by casting in cold Water.

Cuvée, or worked Wine; that which has been let work in the Vat, to give it a Colour.

Cuit, or boiled Wine, that which has a Boiling e're it worked; and which by that Means, still retains its native Sweetness.

Passe, or strained Wine, that made by steeping dry Grapes in Water, and letting it ferment of itself.

Wines, are also distinguished, with Regard to the Colour, into *White Wine*, *Red Wine*, *Claret Wine*, *Pale Wine*, *Rose* or *Black Wine*.—And with Regard to their Country, or the Soil that produces them, into *French Wines*, *Spanish Wines*, *Rhenish Wines*, *Hungary Wines*, *Canary Wines*, &c. And more particularly into *Port Wine*, *Madera Wine*, *Burgundy Wine*, *Champaign Wine*, *Falernian Wine*, *Tokay Wine*, *Schiras Wine*, &c.

Wines, again, are distinguished, with Regard to their Quality, into *sweet Wines*, *rough* or *dry Wines*, and *rich* or *luscious Wines*, *Vins de liqueur*; of which last, some are exceedingly sweet, others sweet and poignant: All chiefly used by Way of Dram, after Meals, &c.

Such are the *French*, *Frontigniac*, *Madera*, the *Canary*, the *Hungary*, *Tokay*; the *Italian*, *Montefascone*; the *Persian Schiras*; the *Malmsey Wines*, of *Candia*, *Chio*, *Lesbos*, *Tenedos*, and other Islands of the *Archipelago*, which antiently belonged to the *Greeks*, but now to the *Turks*.—These are sometimes called *Greek Wines*, and sometimes *Turkey Wines*.

Wine is also variously denominated, according to its State, Circumstances, Qualities, &c.

Natural Wine, is such as it comes from the Grape,

Grape, without further Mixture or Sophistication.

Brewed or adulterated WINE, is that wherein some Drug is added to give it Strength, Fineness, Flavour, Briskness, Sweetness, or some other Quality which is wanted.

Pricked or eager WINE, is that turned sourish.

Flat WINE, is that fallen weak and vappid, for want of being drank in Time.

Sulphured WINE, is that put in Casks, wherein Sulphur has been burnt; in order to fit it for Keeping, or for Carriage by Sea.

Colour WINE, is, some think, a *Wine* of a very deep Colour, serving to dye the *Wines*, that are too pale, &c. as the *black* or *Alicant Wines*, in Use among our *Vintners*.

Chip WINE, is that poured on Chips of Beechwood to fine or soften it.

Rape WINE, is that put in a Cask half full of fresh Grapes picked for the Purpose, to recover the Strength, Briskness, &c. it had lost by Keeping, &c.

The rearing up CORN, is also one of the principal Operations in *Agriculture*.

CORN is a Plant, or rather Genus of Plants, which produces a Grain fit for Bread, the ordinary Food of Man.

CORN is also used for the Grain or Seed of that Plant, separated from the Spica, or Ear.

In the Commerce of Grain they distinguish three Kinds, viz. *Corn* properly so called, or *Wheat*; *Rye*, which is a Species very different, and of a Quality far inferior, and a third Kind resulting from a Mixture of the two, called *Maslin*.

The Farmers, indeed, rank among the Number of *Corn* several of the Grains sowed in *March*; as *Barley*, *Oats*, and even *Pulse*, as *Peas*, *Vetches*, &c. which, however, they sometimes distinguish, by the Denomination of *smaller Corn*; *Maize* and *Sarasin* are numbered among the *Corns*; the first called *Turkey* and *Indian Corn*; the second *French*, or *black Corn*.

Europe, in every Part of it; *Egypt*, and some other Cantons of *Africa*, particularly the Coasts of *Barbary*; and some Parts of *America* cultivated by the *Europeans*, particularly *New England*, *New France*, and *Acadia*; are the Places which produce *Corn*. Other Countries have *Maize* and *Rice* in lieu of it, and some Parts of *America*, both in the Islands and Continents, simple Roots, such as *Potatoes* and *Manioc*.

Egypt was antiently the most fertile of all other Countries in *Corn*; as appears both from sacred and profane History; it furnished a good Part of the People subject to the *Roman Empire*, and was called the dry Nurse of *Rome* and *Italy*. *England*, *France*, and *Poland*, seem now in the Place of *Egypt*, and with their Superfluities support a good Part of *Europe*.

For the first Discovery and Culture of *Corn*, Authors are much divided; the common Opinion is, that in the first Ages Men lived on the spontaneous Fruits of the Earth, as *Acorns*, and the Nut or Mast produced from *Beech*, which they say took its Name *Fagus* from the Greek *φάγω*, I eat. It is added, that they had not either the Use of *Corn*, nor the Art of preparing or making it eatable.

Ceres has the Credit of being the first who shewed the Use of *Corn*, on which Account she was placed among the Gods. Others give the Honour to *Triptolemus*: Others share it between the two, making *Ceres* the first Discoverer, and *Triptolemus* the first Cultivator of *Corn*.

Diodorus Siculus ascribes the whole to *Isis*; in which, *Polidore Virgil* observes, he does not differ from the rest; *Isis* and *Ceres* being in reality the same. The *Athenians* pretend it was among them the Art began, and the *Cretans* or *Candiots*, *Sicilians*, and *Egyptians* lay Claim to the same. Some think the Title of the *Sicilians* best supported, that being the Country of *Ceres*; and others add she did not teach the Secret to the *Athenians*, till she had first instructed her own Country-men. Others say *Ceres* first passed into *Attica*, thence into *Crete*, and last of all

into *Sicily*. Many of the Learned, maintain, however, it was in *Egypt*, the Art of cultivating *Corn* first began; and it's certain there was *Corn* in *Egypt*, and the *East*, long before the Time of *Ceres*.

For the Preservation of *Corn*: It must be well dried and cleaned, the Granary have its Opening to the North or East, and Vent-holes a-top. For the first six Months it must be well stirred every fifteen Days; afterwards it will be sufficient to sift it once per Month; after two Years it heats no more; nor is there any thing to fear, but from the Air and foreign Moisture.

A little Time after the Siege of *Metz* under *Henry II.* of *France*, the Duke d'Espernon laid up vast Stores of *Corn* in the Citadel, which was preserved in good Plight to the Year 1707. when the *French King* and his Retinue passing that Way, eat Bread baked thereof.

The chief Thing that contributes to the Preservation of *Corn*, is a Crust which is formed on its Surface, by the Germination of the Grain underneath, to the Thickness of an Inch and a Half. On that at *Metz* People walked, without its giving the least Way. At *Sedan* was a Granary cut in a Rock, wherein a Heap of *Corn* was preserved one hundred and ten Years: It was covered with a Crust a Foot thick.

At *Chalons* they have Granaries where they still keep *Corn* thirty or forty Years; over the Heap they strew Quick-lime, in fine Dust, to the Thickness of three Inches; and sprinkle this over with Water, whence arises a Crust. The Grain near the Surface sprouts to the Height of a Foot and a Half; these the Winter kills; and the Heap is left untouched till Necessity obliges them to it.

To the same Art, *Agriculture*, belong Planting, Transplanting, Pruning, Engrafting; the Culture of Forests, Timber, Coppes, &c.

PLANTING, in *Agriculture* and Gardening, is the setting of a Tree, or Plant, taken up from its former Place, in a new Hole or Pit proportionable to its Bulk; throwing fresh Earth over its Root, and filling up the Hole to the level of the other Ground.

There are three Sorts of PLANTING, viz. *Planting* an Orchard, *Planting* of Forest-trees, and *Planting* of Wall-fruit Trees. But these are more properly adapted to Transplanting. — Transplanting in *Agriculture*, is the Art of removing Trees or Plants from the Place where they were sowed or bred up, and planting them in others.

ORCHARD, is a Seminary or Plantation of Fruit-trees, chiefly Apples, and Pears.

'Tis a Rule among the Gardeners, that those Orchards, *ceteris paribus*, thrive best, which lie open to the South, South-West, and South-East, and are screened from the North; the Soil dry and deep.

Orchards are stocked by Transplantation; seldom by Semination.

The Season for transplanting Apple Trees into Orchards, is in the Months of *October* and *November*.

If the Leaves be not all off at the Time they are removed, they must be pulled off. They are likewise to be pruned. Trees may be transplanted into Orchards, after three Years grafting; and ought not to be set at a less Distance than eight Yards, nor greater than fourteen: And the richer the Land, the greater the Distance.

The Trees are transplanted to best Purpose, when young: For Trees ten or twelve Years old, a narrow Trench must be dug the *November* before, deep enough to meet the spreading Roots, at such a Distance all around the Tree, as the Roots are to be cut off at; in making the Trench, the Roots to be cut off clean, and without splitting or bruising the Bark, and the Trench filled up again. This will enable the Tree, upon Removal, to draw more Nourishment than otherwise it would; and so thrive better in its new Mansion.

The side Branches of all tall Orchard Fruit Trees, are to be cut off, till the Tree be arrived at the Height desired.

If the Tree be to spread low, some are to be left on each Side; so as to form a kind of Ballance. For the first three Years, at least, they must not grow thick and bushy-headed: This must be prevented by cutting off some of the inside Shoots, and such as grow cross each other, or pendant.

The Soil, if not rich enough, is to be amended in two or three Years; by opening it around the Tree, and on the Outside of the Ground first dug, when the Tree was set; and in a Month's Time filling it up again with a proper Compost or Manure.

In the TRANSPLANTING of *Forest-Trees*, Care is to be taken to preserve the Roots; and even the fine Hairs or Filaments thereof, with the Earth that sticks thereto; these Filaments being the Mouths that suck the Nourishment, and transfuse it to the Tree.

The Pits or Fosses, into which Trees are *transplanted*, should be left open for some Time beforehand, that the Rain, Frost, and Sun may dissolve the compacted Salt, render the Earth friable, and qualify it for nourishing the Tree. — The same may be done, in some Measure, by burning Straw in the new Pits, and drenching the Mould with Water in dry Seasons, and by enriching the Ground with Manure.

Pliny was of Opinion, no Tree should be removed under two, or above three Years old. *Cato* would have none *transplanted* less than five Fingers in Diameter; but we are, now, able to *transplant* Trees of all Ages and Sizes, without Danger.

To *transplant* old Trees was reckoned so difficult, that *veterem arborem transplantare* is become a Proverb for a difficult Enterprize; and yet we are informed of a Grove of 600 Cocoa-trees of 80 Years Growth, and 60 Foot high to the lowest Bough, *transplanted* by Count *Maurice*, to his Paradise of *Friburg*: And a great Person in *Devonshire*, Mr. *Evelyn* tells us, *transplanted* Oaks, as big as twelve Oxen could draw to supply a Defect in an Avenue.

For the *Transplantation* of grown Trees, Mr. *Evelyn* gives the following Method, as practised with good Success by the Lord *Fitzharding*: Choose Trees about the Thickness of a Man's Thigh; remove the Earth from about them; cut through all the side Roots, till the Tree may be, by Force, brought down on one Side; so that the Tap Roots may be conveniently come at to be cut off with the Ax: Then redress the Tree, and let it stand covered with the Mould from which it was loosened, till next Year, or longer; and by that Time it will have drawn new tender Roots fit for *Transplanting*, and may be taken up at a fit Season.

Otherwise, for very large Trees, before the hard Frosts come on, make a Trench about the Tree at such Distance from the Stem, as you judge sufficient for the Root; dig so deep as almost to undermine it: Place Blocks, and Quarters of Wood to sustain the Earth, and cast in as much Water, as may fill the Trench, or sufficiently wet it, unless the Ground were very moist before. — Thus let it stand till some hard Frost bind it firmly to the Roots, and then convey it to its new Station, which may be preserved from Freezing, by placing store of warm Litter in it, so close the Mould the better to the straggling Fibres, and place the Earth taken out of the Pit about the Root of the new-planted Tree.

The common Rules for *Transplanting* are, 1. The lighter the Soil is, the deeper are the Trees to be planted. 2. If the Soil be Gravel, or Sand, mix Clay with it, and *vice versa*. 3. The best Season is either in *October* or *February*; in warm, moist, clear Weather. 4. The large Roots to be abated, to prevent the Necessity of digging too deep; but the small fibrous ones to be spared. 5. In taking up the Trees, to observe how the Roots grow, and in *Transplanting* to dispose them in the same Order, and place the Tree to the same Aspect. 6. To defend young Trees after *Transplantation*, both from the Wind and the Sun, till the Roots be fixed, and they begin to shoot. 7. If the Soil you transplant into, be good, do not

top the Trees, but lop all the Boughs to one single one, the most upright and promising among them; but if the Soil be poor, top them, and when they are shot out again, lop all the Branches to one.

TRANSPLANTING of Fruit-trees. — After a Summer's Growth of Fruit Seedlings in the Seminary, such are pulled up as are above a Foot high, and transplanted into a Nursery; the rest to be left in the Seed-plot till another Year.

When drawn up, the Spriggs are to be cut off, from about the Top, the Strigs from the Roots, and the Extremities both of the Top, that it may not run too fast upwards, and of the Tap or Heart-root, that it may not pass directly downwards; lest it go beyond the good Soil. The Holes or Pits to be so deep, as that the Plants may stand somewhat deeper in the Ground, than when in the Seed-plot; close the Mould about them, and if it be a dry Time, water them the first Day, and cover the Soil with old Fern.

Mr. *Bradley* gives us a new Method of *Transplanting* Trees of all Kinds and Ages with Safety, either while they are in the Blossom, or with Fruit upon them, thus: The Holes to receive the Trees are to be prepared before the Trees are taken up; and the Earth which comes out of the Holes to be made very fine and put into large Tubs, and mixed with Water, till it be about the Consistence of thin Batter. Then the Holes wherein the Trees are to be planted, are to be filled with this thus-tempered Earth, before the earthy Parts have Time to settle.

The Advantage hereof is, that the Trees thus planted have their Roots immediately inclosed and guarded from the Air; and the warm Season of the Year disposing every Part of the Tree for Growth and Shooting, it will lose very little of its Vigour. — In Winter it does not succeed.

The same Author adds, that in Consideration of the Circulation of the Sap, it is as necessary to preserve the Vessels of the Trees entire, as those in animal Bodies, and therefore in *Transplanting* Trees in the Summer Seasons, it is not proper to cut off any of the Branches, or wound any of the Vessels, till they have renewed their Roots, which it is of absolute Necessity to wound in *Transplanting* them. For the wounded Roots he has provided a Plaister of a Mixture of Gums, to prevent the Canker and Rot, and promote their Healing.

PRUNING in Gardening and *Agriculture*, is the Operation of lopping or cutting off the superfluous Branches of Trees; either to dispose them to bear better, to grow higher, or appear more regular.

Pruning is one of the most important Branches of the Gardener's Province; and that whereon the Weal or Woe of his Fruit-trees, as well as the Form and Regularity of his Garden, in great Measure depends.

It is sometimes practised purely for the trimming and adjusting of Trees to the Eye, by taking away irregular Branches; as in Box, Holly, Yew, &c.

Sometimes, to make the Stem grow fairer, and rise higher, by taking off all the large Branches, arising out of it, and thus sending the Sap, which would otherwise be expended by them, to the Top of the Tree, to nourish and prolong the same.

But its more ordinary Use is to render the Tree more fertile and to mend its Fruit, by retrenching such useless Branches as might impoverish the Trunk, and consume the Juice necessary to nourish the Branches that bear.

Pruning is an annual Operation; the Amputation is usually made sloping, sometimes Stump-wise. Its best Season is about the End of *February*, though it may be begun as soon as the Leaves are off, *viz.* in *November*; and continued to the Time fresh Leaves come on, *viz.* in *April*.

As the Gardener has usually three Kinds of Trees to manage, *viz.* some too weak, others too strong, and others in a just Plight; he will find *Pruning-work* enough through all that Space; it being proper to prune some sooner and some later. The weaker

and more languishing a Tree is, the sooner it ought to be *pruned*, to ease it of its offensive Branches: and the more vigorous the Tree is, the longer may the *Pruning* be deferred.

For *PRUNING a Tree of the first Year, i. e.* a Tree planted the Year before: If it have only shot one fine Branch from the Middle of the Stem, it must be cut to that Branch, and the Branch shortened to four or five Eyes or Buds: the Effect of which is, that the next Year there will be, at least, two fine Branches opposite to each other.

If the Tree produce two fine Branches, well placed, with weak ones among them, all required is to shorten them equally, to the Compass of five or six Inches in Length; Care, however, being taken, that the two last Eyes or Buds, of the Extremes of the Branches thus shortened, look on the Right and Left, to the two bare Sides, that each may bring forth, at least, two new ones, and the four being so well plac'd, that they may be all preserved. If one of the two Branches be much lower than the other, or both on one Side, or the like, only one is to be preserved, and that the fittest to begin a fine Figure; the other to be cut off so close, as that it never may be able to produce thick ones in the same Place.—If a Tree have put forth three or four Branches, all in the Extremity, or a little beneath, they must be all pruned by the same Laws as the two above-mentioned: If they be equally thick, they are to be used alike; if some of them be smaller than the rest, they must only be *pruned*, with a Prospect of getting a single Branch each, taking Care to have it on that Side which shall be found empty; in Order to which, they should be shortened to an Eye or Bud, that looks on that Side; and the same Care to be taken in the larger, in Order to begin to fill up the better: If these fine Branches shoot a little below the Extremity, it is but shortening the Stem to them: On the contrary, if the Branches be most of them ill ones, two at least, if possible, are to be preserved, and *pruned* in the same Manner as the two fine ones above. Good weak Branches are to be carefully preserved for Fruit, only cutting them a little at the Extremity, when they appear too weak for their Length, not failing to take away all the sapless Branches.—If the Tree have produced five, six, or seven Branches, it is sufficient to preserve three or four of the best; the rest to be cut quite off, at least if they be thick; but if they be weak, *i. e.* fit for Fruit Branches, they should be kept till they have performed what they are capable of doing; and if among the great ones, there happen to be many small ones, two or three of the best only to be preserved, pinching off the Ends of the longest.

PRUNING of a Tree the second Year.—If having put out two fine wood Branches, and one or two small ones, for Fruit the first Year, the Sap have altered its Course in the second Year, from the thick Branches to the small ones, so that the small become Wood, and the large, Fruit Branches.—If a Tree from the first Year's *Pruning*, have produced four or five Branches, or more, it must needs be very vigorous: For which Reason it may be sometimes advisable to preserve those Branches; even though it be not necessary to the Figure of the Tree, but even to consume Part of the Sap, which might otherwise be prejudicial to the Fruit Branches; these superfluous Branches may be left long, without any ill Consequence; but those essential to the Beauty of the Tree, must be all *pruned*, a little longer than those of the preceding Year, *i. e.* about two, or at most, three Eyes, or a good Foot. This is making an Advantage of the Figure of the Tree, which without this would not yield Fruit in a long Time; the redundant Sap converting all the Sap in Wood-branches. In these vigorous Trees, some Branches cut Stump-wise are to be left on, and even some thick ones, though of false Wood, especially where there are any necessary to the Form of the Tree, or employ the Excess of Sap, and prevent its doing Mischief. Still more to assuage its Violence, it may be necessary to

preserve many long, good, weak Branches, when placed so as to occasion no Confusion; and even on the thick Branches, a good Number of Out-lets for the Sap to range in.—Be it a general Rule, rather to spare the lower Branches, and cut off the higher, than the contrary: By this Means the Tree spreads more easily to the Bottom of the Wall.

PRUNING of a Tree of the third Year.—In a Tree that has been planted three Years, and *pruned* twice, if it be vigorous, as many old Branches as possible are to be preserved, especially for Fruit: If it be weak, it must be eased of the Burden of old Branches, as well those for Fruit, as Wood, it must be cut short, to enable it to shoot out new ones; which if it cannot do with Vigour, let it be pulled up, and a new one, with fresh Earth, planted in its Place.

In all *Pruning*, Provision is to be made for Branches to proceed from those now under the *pruning Knife*, to prepare such as may be proper for the Form; with this Assurance, that when the high Branch is taken down from over the lower, this latter being reinforced with the Sap that would have gone to the former, will certainly produce more Branches, than it would have done without such Reinforcement.

General Rules of PRUNING Fruit Trees, 1. The more the Branches shoot horizontally, the apter and better disposed the Tree is to bear Fruit; consequently the more upright the Branches, the more inclined is the Tree to increase in Wood, and the less in Fruit.

Hence, ever take Care to keep the Middle of a Tree from great Wood, or thick Branches; and as those increase and grow upon you, cut them out entirely; for the Place will be soon filled with better and more fruitful Wood.

In Dwarfs, you are to prune all open, and clear of Wood, leaving none but horizontal Branches; and in Wall Trees, if you do but furnish your Walls with horizontal Branches, Nature will provide for the Middle.—Chuse therefore such Shoots as are not vigorous, to furnish bearing Branches.

2. Take Care the Tree be not left over full of Wood; nor even of bearing Branches; as it is frequently seen in the Management of Peaches, Nectarines, and Cherries.

Nature cannot supply them all with Juice enough; whence none will be supplied well: The Consequence of which is, that either the Blossoms will fall off, or the Fruit dwindle. It is certain, a Multitude of Branches crowding on one another, produces neither so good, nor so much Fruit, as where there is a convenient Space; beside the disagreeable Effect of crossing one another.

3. All strong and vigorous Branches are to be left longer on the same Tree, than weak and feeble ones; consequently, the Branches of a sickly Tree, must be *pruned* shorter, and fewer in Number than those of a strong healthful Tree.

4. All Branches shooting directly forward from Trees that grow against a Wall, are to be *pruned* close to the Branch whence they spring, &c.

5. When a Branch, well placed either against a Wall, or in a Dwarf, has shot some false Wood, neither fit for the Figure nor the Fruit, prune it off within the Thickness of a Crown-piece, or slopingly; though this is best *pinched* off in the Beginning of Summer.

6. Cut off all Branches arising from hard Knobs whereon Pear-stalks grew; or from short Branches, like Spurs.

7. If a Tree, in its Years, have produced Branches of moderate Vigour, and afterwards puts forth strong ones, well placed, though of false Wood; the latter may be used as the Foundation of the Figure, and the other kept a Time for bearing Fruit.

8. When an old Tree shoots stronger Branches towards the Bottom than the Top, and the Top is in ill Case, cut it off, and form a new Figure from the lower

lower ones. If the Top be vigorous, cut off the lower ones, unless well placed.

9. The Order of Nature, in the Production of Roots and Branches, is, that Branch is always less than that out of which it shoots: If this Order be inverted, use them as false Wood.

10. Regard to be always had to the Effects of former *Pruning*, in Order to correct its Defects, or continue its Beauties.

11. In vigorous Trees, the weaker Branches are the Fruit Bearers; in weaker Trees, the stronger chiefly: Therefore in the latter, *prune* off the feeble and small.

12. In vigorous Trees, three good Branches may put forth at one Eye or Bud; in which Case, the two side Branches are generally to be preserved, and the Middlemost cut off in *May* or *June*.

13. It is difficult to strengthen a weak Branch, without cutting off others above it; sometimes it can scarce be done, without cutting off the End of the Branch it shoots out of.

14. The *pruning* of vigorous Peach Trees, to be deferred till they are ready to blossom, the better to know which are likely to bear Fruit.

15. Fruit-buds, next the Ends of Branches, are commonly thick and better fed than others. In weak Trees, therefore, it may be best to *prune* them early, that the Sap may not waste itself in such Parts as are to be retrenched.

16. The farther a weak Branch is from the Trunk, the less Nourishment it receives, and therefore, the more it is to be shortened; but thick Branches, the more distant they are from the Heart, the more they receive; and are therefore to be removed, that the Vigour may extend itself to the Middle, or lower Part.

17. A Branch for Wood must never be *pruned*, without especial Occasion; as where it annoys others.

18. If an old well-liking Tree be disordered with false Wood, through ill *Pruning*, or Want of *Pruning*; take it lower, by cutting off a Branch or two yearly, till it be sufficiently reduced. Some Trees put forth so vigorously, that they cannot be reduced to Compass, in one Year; but must be allowed to extend themselves, otherwise they will produce false Wood.

19. All Trees have a predominant Branch or two, if not more; yet the more equally the Vigour is divided, the better; where it runs much on one Side, it is faulty.

20. The Buds of all Stone-fruit, frequently form themselves the same Year, in which the Branch they grow on was formed: The same holds of Pears and Apples; tho' it is, generally, at least, two or three Years, ere the latter come to Perfection.

21. All Shoots, put forth in Autumn, are to be *pruned* off, as naught: The same may be said of all sapless Branches.

22. When a Tree puts forth much stronger Shoots on one Side, than the other, a great Part of the strong ones must be cut off close to the Body, or some of them Stump-wise.

23. In all Trees, less Length to be allowed the weak, than strong Branches.

24. Upper Branches to be cut off close to others, that they may heal over: Lower Branches are to be cut sloping, or at a little Distance, that new ones may grow out of them.

25. If a young crooked Tree produce a fine Branch beneath the Crook, cut the Head off close to the Branch.

26. Though five, six, or seven Inches, be the ordinary Lengths, Wood-branches are left at; yet must this be varied on Occasion of the Vigour or Weakness of the Tree, Thickness, or Smallness of the Branch, the Fulness or Vacuity of the Place, &c.

27. Be careful not to *prune* many thick Branches standing over weak ones; lest the Sap, which fed the larger, flow so plentifully into the less, as to occasion them to put forth ill Wood, and Suckers.

28. Branches shot from the Ends of others are usually good Wood; sometimes it happens otherwise, and then they must be *pruned*.

As to the grand *Yearly Prunings*:—Fruit Branches being of short Continuance, and perishing the first Year, wherein they produce Fruit, are to be cut off, unless they put forth Shoots, for Blossoms, the succeeding Year. In the second *Pruning*, about the Middle of *May*, where the Fruit is so close, as to be like to obstruct each other, some of them, and their Branches to be taken off, as must also the Multitude of young Shoots, that cause Confusion. Branches more luxurious than others, to be cut clear off.

To preserve old Trees, they must be disburdened, by leaving few Branches, for Wood on them, and those to be shortened to five or six Inches; and very few weak ones, and none dry, and nigh wasted.

PRUNING of Forest, or Timber Trees.—For large Trees, it is best not to *prune* them at all; yet if there be an absolute Necessity for it, avoid taking off large Boughs as much as possible; and observe the following Rules,

1. If the Bough be small, cut it smooth and close, that the Bark may soon cover it; and sloping, that the Water may run off.

2. If the Branch be large, and the Tree old, cut it off at three or four Foot from the Stem, or where any young Shoots are found issuing out of it.

3. Boughs growing upright, not to be cut cross over, but sloping upwards. In Boughs leaning from the Head, the Slope to be on the lower Side.

4. If the Tree grow crooked, cut it off at the Crook, sloping upwards; and nurse up one of the most promising Shoots, for a new Stem. Indeed, in Trees that have great Piths, as the Ash, Walnut, &c. we must be cautious of cutting off the Heads.

5. If the Tree grow Top-heavy, its Head must be lightened; and that the rather by thinning the Boughs that grow out of the main Branches, than by cutting off the main Branches themselves. But if you would have them spring, it is best done by rubbing off the Buds, as they put out in the Spring, and shrowding up the side Shoots.

6. If the side Bough still break out, and a Top be able to sustain itself, give the Boughs that put forth in Spring, a *Pruning*, after Midsummer; cutting them close. This will cause the Bark to cover, and kill them, so as never to shoot out again; and is the only Method to make a Tree grow with a fine, strait, handsome Body.

ENGRAFTING, GRAFTING, or GRAFFING, in *Agriculture* and Gardening, is the Art, or Act, of inserting, or fixing, a Cyon, Shoot, or Bud, of one Tree, in the Stock of another; in order to correct and improve its Fruit.

Engrafting, is the Art of applying a Graft, or Shoot, of one Plant, to the Stock of another; in such Manner, as that the Sap passing freely through both, the Tree *grafted* on, may produce the same Kind of Fruit, with that whence the Graft is taken.

Engrafting only differs from *Inoculation*, in that the latter is performed when the Sap is at the highest in Summer; and the former ere it rises, at least, in any Quantity.

INOCULATION, in *Agriculture* and Gardening, is a Kind of Grafting; or an artificial Operation, by which the Bud of one Fruit Tree, is set into the Branch or Stock of another, so as sometimes to make different Sorts of Fruit grow on the same Tree.

There are various Ways of performing this: The ancient Method was, by making a shallow Incision in the Bark, where the Knot, or a Shoot or Eye, *Oculus*, (whence the Operation takes its Name) begins to bud forth, into which a promising Shoot of another Kind was inserted, and the Incision closed up with fat Earth or Clay.

The Method of *Inoculation* now in the best Repute, as delivered by Mr. *Lawrence*, is as follows: They cut off a vigorous Shoot, from the Tree that is to be propagated, a Month before, or after, Midsummer; then

then chuse out a smooth Place in the Stock (which should not be above three or four Years Growth) making a perpendicular Slit in the Bark a little above an Inch long, and another at right Angles to it, at the lower End, to give way to the opening of the Bark. This done, the Bark is gently loosened from the Wood on both Sides with a Pen-knife beginning at the Bottom.

They then prepare the Bud, cutting it off from the aforesaid vigorous Suit, and taking with it as much of the Wood above as below it, and as near as may be to the Length of the Slit in the Stock.—When the Bud is thus cut off, they take out the woody Part of the Bud, and put the Bud itself in, between the Bark and the Wood of the Stock, at the cross Slit before opened, leading it upwards by the Stalk, where the Leaf grew, till it exactly closes. They then bind it about with woollen Yarn, the better to make all Parts of it close exactly, that the Bud may embody itself with the Stock, which it will do in three weeks Time.

This Operation is said to be best performed in a cloudy Day, or in an Evening; and it is observed, that the quicker it is done, the better it succeeds.

This Practice has the Advantage of Engrafting in many Respects, both as it is more secure, it seldom failing of having Effect, especially if two or three Buds are put into the same Stock; and as its Success is more readily discovered. Indeed when large Stocks are to be practised on, *Inoculation* is not proper, and they are obliged to have Recourse to Grafting.

This one Rule is observed to hold universally, *viz.* That no Success is to be expected in *Inoculation*, if the Sap does not run well; that is, if the Bark will not part readily from the Wood of the Stock.

ENGRAFTING is one of the principal Operations in Gardening, and that whereon the Goodness of our Fruit greatly depends.

It is very extraordinary that the Seeds, or Kernels, or Stones, of a Fruit, as an Apple, Pear, Peach, Plumb, Cherry, &c. being sown degenerate in the Ground; so that the Tree arising from it is of another Kind, a sort of Wilding, harsher, sourer, and courser than that of the parent Tree. To correct this, Trees thus reared, must be *grafted* from other better Kinds.

Apples are commonly raised by *Engrafting* the intended Kinds on Crab-stocks, procured by sowing the Kernels: So are Pears procured by *Grafting* on the wild Pear-stock: Tho' for Dwarf or Wall-trees, they generally chuse to *engraft* on the Quince-stock.

They will do also if *grafted* on the White-thorn. Peaches are produced on an Almond or Plumb-stock. Indeed in this Fruit, it sometimes happens that the Stone sown produces better Fruit than that from which it was taken: But this is not common; beside, that the Tree in such Case, is long ere it comes to bear. Plumbs are raised by *Engrafting* on a Damson, or wild Plumb-stock: And Cherries on the black Cherry, or Merry-stock, raised from Stones.

Our best Gardeners likewise, *engraft* their less kindly Trees from other better of the same Sort, to mend them; as also the smaller and single Flowers, Gilliflowers, &c. from the larger and finer.

To produce Stocks for ENGRAFTING on. The curious furnish us with other extraordinary and anomalous Instances of *Engrafting*: As of Apples on Plane, Elder, Thorn, Cabbage-stalk, &c. and the like of Pears, &c. Pears on Apple-trees, on Elms, &c. Cherries on the Lawrel; Coral-berries on the Plumb: Beech on the Chesnut, Oak on the Elm, Gooseberry on the Currant, the Vine on the Cherry-tree, &c.

*Inseritur lauro cerasus, partuque coæcto
Tingit adoptivus virginis ora pudor.*

Auson.

*Even Daphne's Coyness thou dost mock,
And weds the Cherry to her Stock.*

Cowl. to Evel.

——— *Mutatunq̃ue insita mala
Ferre pyrum, & prunis lapidosa rubescere corna.*
Virg. Geor. Lib. 2.

——— *Steriles platani, malos gessere valentes;
Castaneæ, fagos; ornusque incanuit albo
Flore pyri; glandemque sues fregere sub ulmis.*
Id. Ibid.

The Origin and Invention of *Engrafting*, is differently related by Naturalists. *Theophrastus* tells us, that a Bird having swallowed a Fruit whole, cast it forth into a Cleft or Cavity, of a rotten Tree; where mixing with some of the putrified Parts of the Wood, and being washed with the Rains, it budded and produced within this Tree, another Tree of a different Kind. This led the Husbandman to certain Reflections, from which soon afterwards arose the Art of *Engrafting*.

Pliny sets the Thing in a different Light; a Countryman having a Mind to make a Pallisade in his Grounds; that it might endure the longer, he be-thought himself to fill up and strengthen the Bottom of the Pallisade by running, or wattling it with the Trunks of Ivy. The Effect of this was, that the Stakes of the Pallisades taking Root, became *engrafted* into the Trunks, and produced large Trees; which suggested to the Husbandman the Art of *Engrafting*.

The Reason or Philosophy of *Engrafting*, is somewhat obscure; and had not Hazard given the first Hint, all our Knowledge of Nature had never led us to it. The Effect is ordinarily attributed to the Diversity of the Pores, or Ducts, of the *Grafts*, from those of the Stock, which change the Figure of the Particles of the Juices in passing through them to the rest of the Tree.

Mr. *Bradley*, on Occasion of some Observations of *Agricola*, suggests something new on this Head; the Stock *grafted* on, he thinks, is only to be considered as a Fund of vegetable Matter, which is to be filtered through the Cyon, and digested, and brought to Maturity, as the Time of Growth in the Vessels of the Cyon directs. A Cyon, therefore, of one Kind, *grafted* on a Tree of another, may be rather said to take Root in the Tree it is *grafted* in, than to unite itself with it: For it is visible that the Cyon preserves its natural Purity and Intent, though it be fed and nourished from a mere Crab; which is, without doubt, occasioned by the Difference of the Vessels in the Cyon from those of the Stock; so that *Grafting* may be justly compared to Planting.

In Prosecution of this View of that ingenious Author we add, that the natural Juices of the Earth, by their Secretion, and Commixtion, in passing through the Roots, &c. before they arrive at the Cyon, must doubtless arrive there half elaborated and concocted; and so disposed for a more easy, plentiful, and perfect Assimilation and Nutrition, whence the Cyon must necessarily grow and thrive better and faster than if it were put immediately in the Ground, there to live on coarse Diet and harder of Digestion: And the Fruit produced, by this further Preparation in the Cyon, must be finer and farther exalted, than if fed immediately from the more imperfectly prepared and altered Juices of the Stock.

The Cyon, to say no more, is somewhat in the Condition of the *Fetus in utero*, fed from the Mother's Blood: At least, it is that of the Infant after Exclusion, fed with the Mother's Milk.

The Methods, or Kinds of *Engrafting* are various; as *Grafting* in the Cleft, *Grafting* in the Rind, Whip *Grafting*, *Grafting* by Approach, Scutcheon *Grafting*, Root *Grafting*, reiterated *Grafting*, *Grafting* on Branches, &c.

The Apparatus, or Instrument used therein, are Saws to cut off the Heads of Stocks; Knives to make Clefts; a Chissel to pare away the Wood; Clay, mixed with Horse-dung, to prevent Freezing, and with Tanners Hair to prevent Cracking; Bass-strings,

or

or Woollen-yarn, to tie the *Grafts* with, and *grafting* Wax.

GRAFTING in the Cleft, or *Stock*, called also *slit* *GRAFTING*, is the most antient, and ordinary Way; we have a very beautiful Description of it in *Virgil*, *Geor.* II. v. 78. It is chiefly used for middle-sized Stocks, from one to two Inches Diameter. Its Season is the Months of *January*, *February*, and *March*. —The Method as now practised, is thus.

The Head of the Stock being fawn, or cut off smooth and clean; a perpendicular Cleft is made therein, nearly two Inches deep, with a strong Knife, or Chissel, as near the Pith as may be to miss it. In this Cleft, the *grafting* Chissel, or Wedge, is put to keep it open. The *Graft*, or *Cyon*, is prepared by cutting it aslope, in Form of a Wedge, to suit the Cleft; only leaving a small Shoulder on each Side: and, when cut, is to be placed exactly in the Cleft, so, as that the inner Bark of the *Cyon* may aptly and closely join in the inner Part of the Bark or Rind of the Stock; in the dexterous Performance of which, the chief Secret consists, if the Cleft pinch too tight, a small Wedge may be left in it to bear the Stress. And lastly, the Cleft is covered over with Clay; or rather, as Mr. *Gentil* advises, with Moss, or the fresh Bark of a Tree bound on with Osier.

The Reader, who would have this in more elegant Terms, may be furnished from *Virgil*:

*Aur rursus enodes trunci refecantur, & aliè
Finditur in solidum cuneis via: deinde feraces
Plantæ immittuntur: nec longum tempus & ingens
Exiit ad cælum ramis felicibus arbos,
Miraturque novas frondes, & non sua poma.*

GRAFTING in the Rind, or *Shoulder GRAFTING*, called also *slicing*, and *packing*, is practised in the latter End of *April*, or the Beginning of *May*. —The Method is as follows.

The Top of the Stock is cut off in a smooth, strait Place: Then the *Cyon*, or *Graft*, is prepared by cutting on one Side from the Joint, or Seam down sloopwise, making the Slope about an Inch long; and observing its Bent, that so when the *Cyon* is fixed to the Stock, it may stand nearly upright. At the Top of the Slope, they make a Shoulder, whereby it is to rest on the Slope of the Stock. The whole Slope to be plain and smooth, that it may lie even to the Side of the Stock. As to the Length of the *Cyon*, for a Standard-tree, it may lie about four Inches from the Shoulder; but for a Dwarf, or Wall-tree, six Inches.

The *Cyon* prepared; the Out-side is applied to the West, or South-west Side of the Stock, and its Length and Breadth measured thereon; which done, the Bark of the Stock is cut away to those Dimensions, that the cut Part of the *Cyon* may fit it. Wherein, Regard is to be had to the Bigness of the Stock, and the Thickness of the Bark, to proportion the Length and Breadth of the Chip thereto; otherwise the Passages of the Juice in the Stock and *Cyon* will not meet. Lastly, laying the cut-part of the *Cyon* on that of the Stock, they bind them together with Woollen-yarn, and cover the whole with Clay an Inch above, and as far below, the Stock's Head; working it round the *Cyon*, till it become sharp at Top, that the Rain may run down it.

This Method has several Advantages over the former: As, that the Wound heals up sooner; and that, in the mean Time, it is in less Danger from the Weather; that it does less Injury to the Stocks, and *Grafts*, as avoiding those severe Splittings and Pinchings, that the Bark is more easily placed in the Passage of the Sap here, than in the Cleft: That the *Graft* thrives and shoots with greater Vigour, and bears sooner in this Way than in that; and that it is practicable on smaller Stocks than the other, which must have a good Body and Consistence before they can bear cleaving.

GRAFTING, in the Bark, is performed thus. —Prepare the Stock and *Cyon*, as in *Grafting in the Rind*; but instead of cutting the Bark of the Stock, slit the same on the South-west Side from the Top, almost as long as the sloped Part of the *Cyon*; and at the Top of the Slit loosen the Bark, with the Top of your Knife. Thrust your Instrument, made of Ivory, Silver or the like, and formed at the End like the slope End of the *Cyon* but much less, down, between the Bark and Wood, to make room for the *Cyon*; which being put in the Bark, is to be so managed, as that it may fall close to the Stock, and Edges of the *Cyon*.

GRAFTING by Approach, called also *Inarching*, and *Ablatation*.

Whip-GRAFTING, or *Tongue-GRAFTING*, is a Sort of *grafting* in the Rind, proper for small Stocks, from an Inch Diameter to a Quarter of an Inch. Mr. *London* speaks of it as the most effectual Way of any, and that most in Use.

In this, the Stock and *Cyon* are to be of the same Bigness. The *Cyon* to be sloped off a full Inch, or more; and the like to be done to the Stock; and so the one to be tied to the other. Otherwise the Top of the Stock being cut off, a Shoulder is to be made in the *Graft*: And the rest to be performed as already shewn under *grafting in the Rind*.

This Method is also improved by what they call *tippling* or *tonguing*; which is the making a Slit with a Knife in the bare Part of the Stock downwards; and the like in the sloped Face of the *Cyon*, upwards; and then joining them, by thrusting one Slice into the other, till the bare Place of the *Cyon* cover that of the Stock.

Side GRAFTING. In this the *Cyon* is prepared as in *Whip-Grafting*, but the Head of the Stock is not cut off, only from a smooth Part on the West Side, so much of the Bark is pared off as the *Cyon* will cover; then fitting both *Cyon* and Stock, as in the last Article, they bind the two together, and close them up with Clay. At the Years End the Top of the Stock is cut off at the grafted Place, sloopwise, and the Place covered with Clay.

Scutcheon GRAFTING, is another Method of *Grafting*, in the Rind, practised in *June*, *July*, and *August*; when the Bark will not part from the Stock. It is performed, by fitting the Bark of the Stock in Form of the Capital Letter T, loosening it with the Point of a Knife, and clapping in a *Cyon*, prepared as above.

Crown GRAFTING, is when four or more *Grafts* are placed round the Stock, between the Bark and the Rind, somewhat in the Manner of a Crown. —This is only practised in the larger Trees, which are capable of receiving a Number of *Grafts*, and are too big to be cloven. —The Method is in all Respects the same as that already delivered for *grafting in the Rind*.

Root GRAFTING, is a modern Invention, treated of at large by *Agricola*: Its Intention is somewhat different from the former, being for the Propagation, or Multiplication of Plants.

To perform this, take a *Graft*, or Sprig of a young Tree, which you intend to propagate; and a small Piece of the Root of another Tree of the same Kind, or very like it; or else Pieces of Roots cut off of other Trees, in transplanting; and *Whip-graft* them together: Observing that the two But-ends of the *Graft* and Root be united, and that the Rind of the Root join that of the *Graft*. These may, afterwards, be planted out at Pleasure, and the Piece of Root will draw the Sap, and feed the *Graft*, as the Stock does the other Way.

This Way of Propagation is very easy and expeditious; Roots being more plentiful than Stocks: By this Method the Pieces of Roots of one Crab-stock, or Apple-stock, will serve for 20 or 30 Apple *Grafts*, and the like of other Trees. The same is an excellent Way for raising of tender Trees, that will hardly bear

being *grafted* in the Stock. Add, that Trees thus *grafted*, bear sooner, and are more easily dwarfed than those done any other way.

Reiterated GRAFTING, or *grafting by a double, or triple Incision*, is another Method mentioned by *Agricola*: To perform which, first graft a good Cyon on a Stock, and cut it away to one Half, or a third Part; then fix another *Graft* to it, of a better Kind; and a third to that: For still the oftner a Tree is *engrafted*, the finer Fruit it produces.

By this Method, that Author assures us, he produced Muscat Pears, that were admirable; making, at first, use of a Stock *grafted* with a Pound Pear, on which he *grafted* a Summer *Bon Chretien*; and when the Branch of this latter had shot, he *grafted* on it a Cyon of Bergamot, which he also cut, and *grafted* on it a Cyon of Muscat Pear.

ENGRAFTING of Branches, *Agricola* mentions as a very certain and profitable Operation, best practised on large full grown, and even old Trees.

To do this, half or more of the Branches must be lopped off, and *Grafts* of three or four Years old be applied to them; taking Care to have Stakes or other Things to support them against the Wind, &c.

He adds, that by this Method, you will have, perhaps, the same Year, at least, the second or third, such a Quantity of Fruit, as the youngest and soundest Tree would hardly produce.

All Sorts of Trees are raised in a *Nursery*, which is a *Seminary* or Seed-plot.

Some Authors make a Difference between *Nursery*, and *Seminary*, holding the former not to be a Place wherein Plants are sown; but a Place for the Reception and Rearing of young Plants, which are removed, or transplanted hither from the *Seminary*, &c.

Mr. *Lawrence* recommends the having several *Nurseries*, for the several Kinds of Trees: One for tall Standards; viz. Apples, Ashes, Elms, Limes, Oaks, Pears, Sycamores, &c. Another for Dwarfs; viz. such as are intended for Apricots, Cherries, Peaches, Plumbs, &c. And a third for Ever-greens.

The *Nursery* for Standards, should be in a rich, light Soil, sown with the proper Seeds, in *October* or *November*. For Apples, and Pears, Crab, and wild Pear Kernels, are to be preferred for Stocks: Elms and Lime are to be raised from planted Suckers: Walnuts to be sown with the green Shell upon them, to preserve them from Mice. This *Nursery*, if it be well managed and weeded for two Years, the Crabs and Pears will be fit for grafting and inoculating the third Year.

Firs and Pines are to be raised from those little Seeds taken out of their large Apples.

The *Nursery* for Dwarfs does best by itself, that it may not be over-topped by taller Trees. Stones of Apricots and Peaches are not proper to raise those Trees; but in lieu thereof, sow the Stones of Pear-plumbs, Muffel, or *bonum magnum* Plumb; which prove better and more lasting than the former. For Stocks of all Sorts of Cherries, black Cherry-stones do best.

Mr. *Mortimer* directs all Stone-fruit to be sown quickly after gathering; for that if they be kept, they will be two Years e'er they come up. Add, that if they have not all the Moisture of the Winter to rot the Shells, the Kernel will scarce come up at all.

To furnish the *Nursery* of Ever-greens, the several Sorts of Seeds or Berries, as Yew, Holly, Juniper, &c. are to be put in so many distinct Pots or Boxes, with fine Mould over them, and thus buried for a Year; after which, they are to be taken out and sown.

EVER-GREENS, are a Species of Perennials, which continue their Verdure, Leaves, &c. all the Year.

Of these, our Gardeners reckon twelve, fit for *English* Air, viz. the *Alternus*, *Arbutus*, *Bay Tree*, *Box Tree*, *Holley*, *Juniper*, *Laurustinus*, *Phyllirea*, *Pyracantha*, or Ever-green Thorn, *Italian* green *Pri-vet*, and the *Yew Tree*. If they were to be sown

when gathered, like other Seeds, they would not come up the first Year, nor grow so kindly.

GARDENING, or *Horticulture*, is also a Branch of *Agriculture*.

Gardening, *Horticulture*, is the Art of cultivating a *Garden*.

GARDEN, is an Inclosure, or Plot of Ground, curiously cultivated, and furnished with Variety of Plants, Flowers, Fruits, &c.

Gardens are distinguished into Flower-gardens, Fruit-gardens, and Kitchen-gardens: The first for Pleasure, and Ornament; and therefore placed in the most conspicuous Parts: The two latter for Service; and thereof made in By-places.

In a *Garden*, the principal Things to be considered, are, the Form, Soil, Situation, and Aspect or Exposure.

For the Form; a Square, or rather Oblong, is most eligible; leading from the Middle of the House, with a Gravel Walk in the Midst; narrow Grass-borders on each Side, and on either Side of these, Rows of Variety of Winter-greens. If the Ground be irregular, it may be made uniform, so as to afford a Prospect, nothing inferior to the most regular; strait Lines will reduce any Figure to Order. A Triangle has its Beauty, as well as a Square; and the most irregular Spots may be brought by Borders, and Walks, to those two Figures.

Indeed an Irregularity is easily hid in a large *Garden*, by long Walks and tall Hedges, interrupting a distant View: And the little Corners, and triangular Spaces, may be agreeably filled up with Borders of Flowers, Dwarf Trees, flowering Shrubs, or Ever-greens. Nor is it prudent, to be solicitous to throw the whole *Garden* into a single View; as Irregularities and Unevennesses, afford many uncommon, pretty Devices, &c.

For the second Point, or the *Soil*; a deep, rich, black Mould, is best for Plants; sandy Land is warm and forward, and good for Flowers; chalky Land is cold and backward. But both are easily corrected by Composts, or Materials of opposite Kinds.

For the Situation: If a *Garden* be too high, it will be exposed to the Winds, which are highly prejudicial to Trees; if too low, the Dampness will be injurious, beside the Breeding of Vermin: A Flat, therefore, or the Side of a Hill, are the happiest Situations, especially the latter, as it is usually well watered, and sheltered from the Extremities of the Weather; beside that, the Water descending from on high, will supply Fountains, Cascades, and other Ornaments of a *Garden*.

The *EXPOSURE*, or *EXPOSITION*, is the Aspect, or Situation of a *Garden*, Wall, Building, or the like, with respect to the Sun, Winds, &c.

There are four regular Kinds of *Exposures*, viz. *East*, *West*, *North*, and *South*; but it must be observed, that among Gardeners, these Terms signify just the contrary to what they do among Geographers.

The Gardeners, in Effect, do not give the Names *East*, *West*, &c. to the Places where the Sun is; but to those whereon he shines, whether as to the whole *Garden*, or some one of its Sides.

If they find that the Sun, at his Rising, and during the first Half of the Day, continues to shine on one Side of the *Garden*, or Wall; they call that an *Eastern Exposure*, or *East Wall*, &c. And if the Sun begin to shine later, or end sooner, it is not a proper *Eastern Exposure*.

For the same Reason, they call the *West*, the Side the Sun shines on the latter Part of the Day, i. e. from Noon to Night. And accordingly, the *South*, or *Southern Exposure*, is the Place whereon he shines, from about nine o'Clock in the Morning, till Night, or which, in the general, he shines longest on in the whole Day; and the Part he shines least on, is the *North*, or *Northern Exposure*, at what Hour soever it begin, or end, being usually from eleven o'Clock, to one.

Such

Such is the Gardeners Language, with Regard to the *Exposures*, and particularly those of Walls; by which we are let into the Signification of this, or the like Expressions, usual among them.—My East Wall proves, hits, or thrives better, than the West. My Eastern Fruit Trees, have had fewer Flowers, than my Western, &c. The *Eastern* and *Southern Exposures*, are, by common Consent of all Gardeners, the two principal; and have a considerable Advantage above the rest. A *West Exposure* is not much amiss; at least, it is better than a *Northern* one, which is the worst of all. Each has its Inconveniencies.

The *Eastern*, commencing differently, at different Seasons of the Year, and ending about Noon, subjects the Trees, &c. to the *N. E.* Winds, which wither the Leaves, and new Shoots, blow down the Fruit, &c. Beside that, it has little Benefit of Rains, which come mostly from the *West*. Yet does the Reverend Mr. Lawrence, judge the *East*, better than the *West* Wall, for all Kinds of Fruit: Not that it has more Hours of Sun, or that there are any peculiar Virtues in the *Eastern* Rays; but because the early Rays of the Sun, do sooner take off the cold, chilly Dews of the Night.

M. Gentil recommends the *Eastern Exposure*, as best for all Kinds of Peaches; adding, that they ripen soonest, grow bigger, are better coloured, and of a finer Taste than any other: But Mr. Carpenter restrains the Rule to the early and middle Sort; for the backward, he rather chuses a *Southern*, or *South-East Exposure*, which is the best for all late Fruits; because the Sun is strongest, and continues longest therein.

The *Eastern*, accounted from half an Hour past eleven, till Sun-set, is backwarder than an *Eastern* one, by eight or ten Days; but it has this Advantage, that it receives little Damage from the Frosts, which melt before the Sun comes to shine upon the Fruit, and fall off like Dew, without doing any Prejudice; so that it may bear Apricots, Peaches, Pears, and Plumbs, but it is incommoded with North-West Winds in the Spring, as also with autumnal Winds, which blow down a deal of Fruit.

The *Northern Exposure* has less Sun than the *West*; yet it is not without its Advantages. In the Northerly Parts of *England*, it bears little but Pears, Cherries, and Plumbs. But in the warmer Parts, it serves for Apricots, which have the Advantage of continuing later, than any other *Exposure*, besides being free from Insects.

The *Southern Exposure*, accounted from about nine till four, is recommended for Peaches, Pears, Grapes, and Plumbs.

Of all Things, the Ground or Soil of the *Garden* is the most important: Unless this be rich, and fertile, all the other Advantages will be in vain. To judge of the Quality of the Soil, some direct us to look, whether there be any Heath, Thistles, or other Weeds growing spontaneously therein, as a certain Sign of poor Ground. The Growth of the Trees, too, thereabout, is to be considered; if they grow crooked, ill shaped, and grubby, of a faded Green, and full of Moss; the Place is to be immediately rejected. If the contrary be found; you must proceed to examine the Depth of the Soil, by digging Holes under Ground. The Soil should be three Foot deep, but less than two is not sufficient.

The Chief Furniture of Pleasure-gardens are, *Parterres*, *Villa's*, *Glades*, *Groves*, *Compartiments*, *Quincunxes*, verdant Walls, arbour Work, Mazes, Labyrinths, Fountains, Cabinets, Cascades, Canals, Terraces, &c.

PARTERRE, is that open Part of a Garden, into which we enter, coming out of the House: usually, set with Flowers, or divided into Beds, encompassed with Platbands, &c.

The *Parterre*, is a level Division of Ground, which, for the most Part, faces the South, and best Front of the House, and is generally furnished with Greens, Flowers, &c.

There are divers Kinds of *Parterres*, as Bowling-green, or plain *Parterres*; *Parterres* of Embroidery; *Parterres* cut in Shell-work, in Scroll-work, &c. with Sand-allies between.

An Oblong, or long Square, is accounted the most proper Figure for a *Parterre*, the Sides whereof, to be as two, or two and a Half to one.

FLOWERS make the greatest Ornament of a *Parterre*; these Flowers are distinguished into early or *Spring Flowers*, which flourish in the Months of *March*, *April*, and *May*.

Such are the Animonies, Daffodils, Hyacinths, Tulips, Junquils, Cowslips, Primroses, &c.

Summer FLOWERS, which open in *June*, *July*, and *August*, as Pinks, Gilliflowers, Lillies, Daisies, Campanulas, Poppies, Sun-flowers, &c.

Autumnal, or *late* FLOWERS, denote those of *September* and *October*; as the *Oculus Christi*, Indian Pinks, and Roses, Pansy, Flower-gentle, &c.

Of these FLOWERS, those which subsist all the Year, we mean in the Stem, or Root, at least, are called *Perennials*.

And those which are to be planted, or sowed afresh every Year, according to the Season, are called *Annuals*.

Vista, is an open and light Passage made through a thick Wood, Grove, or other like, by lopping off the Branches of Trees, along the Way.

GROVE, is a little thick Wood.

The antient Romans had a Sort of *Groves* near several of their Temples, which were consecrated to some God, and called *Luci*, by *Antiphrasis à non lucendo*, as being shady and dark. In large and magnificent Gardens, a *Grove* is usually a Plot of Trees, inclosed with Palisadoes, consisting of tall Trees, as Elms, Horse-chestnuts, &c. the Tops whereof make a Tuft, or Plump, and shade the Ground below.

At the Foot of the tall Trees, which generally run all along the Palisadoes at equal Distance; other lesser Trees are often planted, whose Tufts form a Resemblance of a Sort of Copse, within the former.

COMPARTIMENT, is a Design composed of several different Figures, disposed with Symetry, to adorn a *Parterre*.

ALLEY of *Compartiment* is that which separates the Squares of a *Parterre*.

ALLEY, in Gardening, a strait, parallel Walk, bordered or bounded on each Hand with Trees, Shrubs, or the like.

The Word *Alley*, is derived from the *French* Verb *aller*, to go; the ordinary Use of an *Alley* being for a Walk, Passage, or Thorow-fare, from one Place to another.

Alleys are usually laid either with Grass or Gravel.

An *Alley* is distinguished from a *Path* in this; that in an *Alley* there must always be Room enough for two Persons, at least, to walk a-breast: So that it must never be less than five Feet in Breadth; and there are some who hold, that it ought never to have more than fifteen.

Counter ALLEYS, are the little *Alleys* by the Sides of the great ones.

Front-ALLEY, is that which runs strait in the Face of a Building.

Transverse ALLEY, that which cuts the former at right Angles.

Diagonal ALLEY, that which cuts a Square, Thicket, *Parterre*, &c. from Angle to Angle.

Sloping ALLEY, is that which either by Reason of the Lowness of the Point of Sight, or of the Ground, is neither parallel to the Front, nor to the transverse *Alley*.

ALLEY in *Ziczac*, is that which has too great a Descent, and which, on that Account is liable to be damaged by Floods; to prevent the ill Effects whereof, it has Platbands of Turf run across it from Space to Space, which help to keep up the Gravel.

This last Name is likewise given to an *Alley* in a Labyrinth, or Wilderness, formed by several Returns

of

of Angles, in order to render it the more solitary and obscure, and to hide its Exit.

ALLEY in *Perspective* is that which is larger at the Entrance than at the Exit; to give it a greater Appearance of Length.

QUINCUNX, is chiefly used in Gardening, for a Plantation of Trees, disposed originally in a Square; consisting of five Trees, one at each Corner, and a fifth in the Middle; which Disposition repeated again and again, forms a regular Grove, Wood, or Wilderness, and when viewed by an Angle of the Square, or Parallelogram, represents equal and parallel Alleys.

Or, the *Quincunx* is the Figure of a Plantation of Trees, disposed in several Rows, both Length and Breadth-wise; in such a Manner as that the first Tree of the second Row commences in the Centre of the Square formed by the two first Trees of the first Row, and the two first of the third; resembling a Figure of five at Cards. — The finest manner of planting Trees to form a Grove, is in the *Quincunx*. It is of this kind of *Quincunx* that *Cicero* speaks in his *Catoma*; and *Quintilian*, Lib. 8. cap. 3.

The modern *Quincunx*, *Daviler* observes, are made like those of the Antients, except for the fifth Tree, which is now generally disused; so that being as it were, netted, and their *Alleys* viewed by the Side of the Rectangle, they form a perfect Chequer.

The *Kitchen Garden* is to be planted with Fruit-trees, Pulses, Salads, &c.

In the planting of Fruit-trees, if the Soil be a hungry Gravel, or Sand, Mr. *Switzer* directs where the Trees are to be planted, to be dug two Feet deep, and three or four over, and filled with rotten Horses or Cows Dung, mixed with rich Mould: If it be Marle or stiff Clay, a Compost of Rubbish, Lime, Pieces of Brick, Ashes, Sand, &c. with the best to mix with Dung and Mould; though he is of Opinion, that untried Earth, dug from a Waste or Common where Cattle have been fed, would prove the best Soil for young Trees.

The Trees being now taken out of the Nursery, the biggest Roots are to be shortened to about six Inches; all the small Fibres taken off; and the Head to be pruned, so as not to leave above two Branches; and those not above six Inches long.

The Wall-trees, to be placed as far from the Wall as possible; that there may be the more Room for the Roots to spread. Then filling up the Hole with Mould, there remains nothing but to secure the Roots from the Winter's Frost, by covering the Spot with Straw, Fern, Dung, &c. And in Summer, from the Sun; by Sand, and pebble Stones.

For Trees planted in Borders, the common Practice is to make a Trench by the Wall Side, two Foot broad, and as many deep. This Trench they fill with old Dung, mixed with Earth, lightly laid, near as high as the Borders are intended to be; and then trodden down to half the Height in the Places where the Trees are intended to be. It is prudent to plant the Trees shallow, and to raise the Earth about them; especially in a wet, clayey Soil. It is an Observation of some Importance, that Wall-trees and Fruit thrive best, when the Walks that run parallel to them, are Gravel; more of the Rays of the Sun being thereby reflected to them, than if they were Grass. Add, that no sort of tall Trees are to be suffered to grow in any of the opposite Borders, or intermediate Spaces, so, as their Shade might reach to the South-east or South-west Walls. The Places near the Walls are most advantageously filled with Dwarfs.

DWARF-TREES, a sort of diminutive Fruit-trees, frequently planted in the Borders of Gardens: Thus called from the Lowness of their Stature.

They seldom grow above four or five Foot high; and have usually a Hoop tied within the Middle of the Branches to make them spread around.

Dwarf Trees are of special Advantage for Table Fruit, whether, Pears, Apples, Plumbs, or Cherries; the Fruit they yield is usually the finest and

best; and such as make a considerable Article in the Gardiner's Province.

There are divers Ways of producing *Dwarfs*. — *Dwarf-Pears* are usually had by inoculating on Quince-stocks, which grow the *Dwarfs* Height.

As for *Dwarf-Apples*, the Stocks they chuse to graft on are those raised of the Cuttings of the Apple-tree. — In order to provide Stocks of each Kind, they chuse such Stems, and Branches, as grow straightest, in the Month of *October*, from Trees whose Cuttings will grow, or which in the Places they are to be grafted in are at least an Inch thick: These they cut off an Hand's Breadth below the Knots or Burs, which are the Places where they usually put forth their Roots; and cut off the Top that they may not be above a Yard long. If they cannot be got so long of Quinces, shorter must do. Cut off all side Branches close to the Body, except one small Twig near the Top for the Sap to vent itself at. Set them in Beds, as seed Plants are: And keep them a Foot above Ground.

It being somewhat difficult, to get enough of such Branches as have Burs and Knots on them; a particular Method has been invented to bring those Knots, and Burs, artificially, called *Circumposition*. It is performed by tying some Earth in a Piece of old Hat, a Foot long, about the Place where you intend to cut, in the Month of *February*, and in *October* it will have shot Roots therein.

Such Trees alone as are apt to put forth Roots, are proper for *Dwarf* Stocks; as the Kentish Codlin, Gennet Moil, some sorts of sweet Apples, Bittersweets, the Quince-tree, Mulberry-tree, Paradise Apple-tree.

Stocks for *Dwarf* Apple-trees are likewise raised by cutting down an old Tree, which is apt to cast forth good Suckers from the old Roots; which at two Years Age may be transplanted, or else inoculated where they stand.

As for *Dwarf* Pear-trees, Stocks may be raised for them from the Suckers of old Pear-trees: Else cut off the Top of some old ill Pear-tree, and the Roots will cast forth Suckers.

For *Dwarf* Cherries and Plumbs, Suckers of the common Red Cherry, and ordinary Plumb-tree are the best.

As to the grafting or inoculating of *Dwarf Stocks*, it must be done as low as may be, with two Cyons, and those longer than in grafting for long Standards that they may spread from the Ground.

As to the planting of *Dwarf-trees* it is best in a light, hot Earth, from the Beginning of *October*, to the End of *November*. In cold, wet Soil, it is best in *March* and *April*. The Stem of the Tree to be cut off seven or eight Inches above the Graft; and remember to cut off half the Length of the Roots and hairy Fibres; to turn the Cut of the Tree towards the North; to let the Graft always be two or three Inches above the Ground, lest it take Root; to plant them shallow, as being apt of themselves, in light Ground to sink a Foot deep, which is sufficient; and to cover the Ground, when they are planted with Horse-litter.

ESPALIER, in the *French* Gardening, is a Wall-tree; or a Fruit-tree; which is not left to grow at Liberty in full Air, but has its Branches nailed or fastened to a Wall, near which it is planted; and thus growing, it is made to conform itself to the Flat, though unnatural, Figure thereof.

Espaliers, in our Gardening, are Rows of Trees, planted regularly round the Out-side of a Garden, or Plantation, for the general Security thereof, from the Violence and Injury of the Winds; or else only round some Part of the Garden, for the particular Security of a Plantation of Orange-trees, Lemon-trees, Mirtils, or other tender Plants; or lastly, for the bounding of Borders, Walks, Avenues, &c.

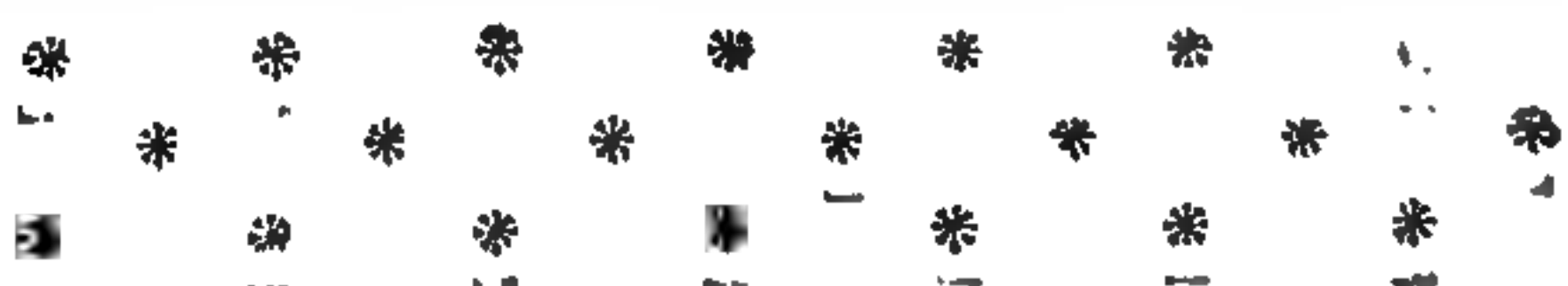
Espaliers are now come into mighty Use, with Respect to the first of these Intentions: In Effect, it is found by Experience, that the best Brick, or Stone-Walls,

Walls, are not of themselves sufficient Security to Fruit-trees, from the Ravages of blighting Winds.

The Reason may be, that being built close and compact they repel the Winds, and by that Means damage the tender Plants, that lie within the Reach of the Repulsion. But these *Espaliers* serve to deaden the Violence of the Winds, so as the tender Greens, or Plants, encompassed by them, rest serene and quiet.

Thus, if the *Espaliers*, for Instance, be of spruce Holly, or Yew, they give way to the Force of tempestuous Winds beating against them without occasioning any Resilition thereof.

Mess. *London* and *Wife*, direct them to be planted at some Distance, without the utmost Bounds, or Walls of Gardens, &c. two or three Rows of Trees, they think sufficient, from 18 or 20 to 25 Foot apart. And as to the Method or Order, of disposing the Trees, the most commodious is where the Middle-row makes every where equilateral Triangles with the extreme Rows, in the following Manner.



The Trees recommended for making, or planting, these *espalier* Fences, are the Elm, Lime, *Scotch* Fir-pine, and Sycamores; but particularly the two first.

As for *espalier* Hedges, or Hedge-rows for Defence of tender Greens and Plants, from destructive Winds in the summer Season; if there be no Occasion to use them the first or second Year after they are planted; a substantial Frame of Wood must be made seven or eight Foot high, with Posts and Rails. And to this *espalier* Frame, must the side Boughs of the young Trees be tied, to cause the *Espalier* to thicken the sooner.

For the Form of such an *Espalier*, it must be Ob-long, running North and South.—It may be planted with Apples, Pears, Holly, Laurel, Lime, Maple, White-thorn, Yew, &c.

To prevent the Disorders that might befall *espalier* Fruit-trees when in Blossom, Mr. *Bradley* mentions a nursery Man at *Brentford*, who having most sorts of Fruit in *Espaliers*, has portable Hedges made of Reeds in Frames, which he sets both at the Back, and Front of his *Espaliers*, as he sees Occasion.

With regard to *Fruit-trees*, Mons. *Quintinie* observes, 1. That the cutting and trimming of young Trees, hinders them from quick bearing; though it contributes both to the Beauty of the Tree, and the Richness and Flavour of the Fruit.

2. That *Kernel Fruit-trees*, come later to bear than *Stone Fruit-trees*; the Time required by the first before they arrive at a fit Age for bearing, being, one with another, about four or five Years: But that when they do begin, they bear in greater Plenty than *Stone-fruit*.

3. That *Stone-fruit*, Figs, and Grapes, commonly bear considerably in three or four Years; and bear full Crops the fifth and sixth Years; and hold it for many Years, if well ordered.

4. That *Fruits* in the same Neighbourhood will ripen a Fortnight sooner in some Grounds, than in others of a different Temperature.

5. That in the same Spot, hot or cold Summers set considerably forward, or put backwards the same *Fruit*.

6. That the *Fruits* of *Wall-trees* generally ripen before those on *Standards*; and those on *Standards* before those on *Dwarfs*.

7. That the *Fruits* of *Wall-trees* planted in the South and East Quarters commonly ripen about the same Time; only those in the South rather earlier than those in the East; those in the West are later by eight or ten Days, and those in the North by fifteen or twenty.

Monsieur *de Reffons*, in the *Memoires de l'Academie Royale des Sciences*, Anno 1716. gives a Method of

grafting *Stone Fruit-trees* without losing of Time; so that a Tree which bore sorry Fruit the preceding Year, shall bear the choicest the Year following.

It frequently happens, that Persons are deceived in their *Fruit-trees*: Especially those bought of the nursery Men: And it is a melancholly thing, after having waited three Years for *Fruit*, to find it naught at last; and to be obliged to graft the Tree again, and wait four Years more, for the second Hopes; in Effect, in the common Methods of Grafting, they know nothing better than to cut off the Head of a Tree; and make it put forth new Wood, to graft in. This necessarily makes a long Delay; which Monsieur *Reffons* shews how to abridge.

Upon considering the Union of the Sap in Grafts, that Author was led to think, that all the Office the Bark has in Grafting, is to receive the Scutcheon; so that if the Bark be not quite hard, dry, and inflexible, and incapable of yielding without cracking, or bursting; it should seem indifferent, whether one grafted on new Wood, or old, the Sap passing equally into both; which Reasoning had the Fortune to be verified by a Number of Experiments made with that View.

We are at Liberty, then to graft at any Age, and in any Wood. Accordingly, a Peach-tree of a worse Kind or Quality, may be grafted from another of the best, in Autumn in the Height of its *Fruit* and Sap, without cutting off the Branches above the Grafts the Spring following; the same Graft inserted the preceeding Autumn will shoot vigorously; and being on a Wood of the same Kind, the *Fruit* thenceforth produced will be much the larger and finer. But this is not the great Point: For the Tree thus engrafted will not bear till the third Year; and we want *Fruit* the first.

In order to this, it is to be observed; that there are three Kinds of Branches: Wood-branches growing immediately from the Stem or Stock of the Tree: *Fruit*-branches; and Branches half Wood half *Fruit*; being such as arising from the largest Wood-branches preserve the Character thereof, but which in two Years Time will produce *Fruit*-branches. Now, it is these intermediate Kind of Branches, that we are to chuse for Scutcheons or Grafts. They are readily known by being bigger than the *Fruit*-branches, and less than the Wood-branches: They have each of them two, three, four, or even five Leaves to each Eye, and the Eyes are further distant from each other than those of the *Fruit*-branches, but closer than those of the Wood-branches. It must be added, that the Eyes on such Branches are three, one, intended for a Wood-branch, being situate between the two Leaves and advancing further than the other two, which are intended for *Fruit*, and are placed without side the Leaves. These last are the precise Subjects to be chosen for the Grafting withal. Twelve of these Branches, more or less, according to the Strength of the Tree to be grafted on, being duly applied, we may depend on a Crop of good *Fruit* the very next Year, on the same Tree which last Year produced the worst.

The Production of a Fruit Tree, is called *Fruit*, as the Apple, Pear, Plumb, Apricot, Cherry, Grape, Currant, Orange, Fig, Almond, &c.

Fruits are distinguished into *Stone-fruit*, and *Kernel-fruit*; *Summer-fruit*, and *Winter-fruit*; *Wall-fruit*, and *Dwarf-fruit*, &c.

Monsieur *Quintinie* observes that cold, heavy, moist Lands produce the fairest and largest *Fruit*; but the hotter, dryer, and lighter, the more delicious and rich tasted.

Fruits, with regard to Commerce, are distinguished into *recent*, or *fresh*; and *dry*.

Recent *Fruits* are those sold just as they are gathered from the Tree, without any further Preparation.—As are most of the Productions of our Gardens and Orchards, sold by the Fruiterers.

Dry *Fruits* are those dried in the Sun, or by the Fire, with other Ingredients, sometimes added to them.

them, to make them keep; imported chiefly from beyond Sea, and sold by the Grocers.

Such are Raisins, Currants, Figs, Nutmegs, Pepper, and other Spices.

Under the Denomination of *dry Fruits* are also frequently included Apples, Pears, Almonds, Filberds, &c.

RAISINS, Grapes prepared by drying them in the Sun, or in Ovens; to fit them for keeping, and for some medicinal Purposes.

Of these there are various Kinds; as *Raisins of Damascus*, thus called from the capital City of *Syria*, in the Neighbourhood whereof they are cultivated. They are much used in the Composition of *Pisians*, together with Jujubes and Dates; are brought flat and seeded, of the Size of the Thumb; whence it is easy judging of the extraordinary Bulk of the Grape, when fresh. Travellers tell us of Bunches weighing 25 Pounds. Their Taste is faintish and disagreeable.

Raisins of the Sun, are a Kind of *Raisins* brought from *Spain*, of a reddish or bluish Colour, seeded very agreeable to eat.

There are various other Sorts, denominated from the Place where they grow, or the Kind of Grape, &c. as *Raisins of Calabria*, *Muscadine Raisins*, &c.

CURRENTS or *Curranis*, are a kind of little Raisins, or dried Grapes, of different Colours, black, white, or red; brought from several Places of the *Archipelago*, and amongst others from the Isthmus of *Corinth*; whence their Name, *Currants*, q. d. *Corinths*.

They must be chosen new, small, and in large Masses; and Care be taken that the little *Spanish Currants*, be not soiled in their Room.——When made up in Bales, they may keep two or three Years, without stirring, or giving them air.——Their Use is in seasoning several Viands, and in some medicinal Composition; where they serve in lieu of Raisins. Sir *George Wheeler's* Account of these Fruits, and the Manner of preparing them is very curious.——The Island of *Zant*, he observes, is the chief Place whence *Currants* are brought: The *Morea*, or the Isthmus of *Corinth*, which was antiently the principal Plantation, and whence the *Latins* denominated them *uva corinthiacæ*, now, produces no more; as having been much neglected: The Jealousy of the *Turks* not allowing large Vessels to enter the Gulf, to take them off their Hands.

They do not grow on Bushes, like our Gooseberries, though that be the common Opinion; but on Vines like other Grapes; except that the Leaves are somewhat thicker, and the Grapes somewhat smaller: They have no Stone; and, in this Country, are all red, or rather black.

They gather them in *August*, dispose them on Couches on the Ground till they be dry, clean them, and lay them up in Magazines, which the Natives call *Seraglio's*; pouring them in at a Hole, till the Magazine be full; they cling so fast together by their own Weight, that they are forced to be dug out with iron Instruments.

To barrel them, for sending abroad, they have People who grease their Feet and Legs, and tread them close, that they may keep the better. They are sold for about twelve Crowns the thousand Weight, and pay as much Custom to the State of *Venice*.

Zant produces enough yearly to load five or six Vessels; *Cephalonia* three or four; and the other Islands one: The *English* have a Factory at *Zant*; the *Dutch* two or three Merchants, and the *French* one: The *English* consuming more than six times the Quantity than both *France* and *Holland* do together.

Those of *Zant* know but little of the Use we make of them; being persuaded they only serve in dying Cloth; and being intirely ignorant of the Luxury of *Christmas Pies*, and *English Puddings*.

There are some other Particulars relating to the Art of Gardening, as *Pinching*, and *Variëgating*.

PINCHING, is a Sort of Pruning performed by nipping, or breaking off the Branches, or Sprigs of

a Plant, or Tree, between the Nails of two Fingers.

Most Gardeners hold that *Pinching* contributes to the Abundance of the Fruit as well as of the Branches; and say; that young Shoots, thus lopped, are less apt to grow black and dye, than when cut with a pruning Knife.

The Season for *pinching* is chiefly in *April* or *May*, sometimes it is also practised in *June* and *July*.——The Fruits it is practised on are chiefly Melons, Cucumbers, &c. *Quintiny* also prescribes it for Fruit-trees.

It is chiefly to be practised on the large Branches towards the Top of the Tree, which are useless and yet consume a great Quantity of good Sap. It must rarely be employed on the large Branches below; which ought always to be preserved for the Winter's Pruning, that they may yield others, the following Year, fit to fill the empty Places.——Nor must the Operation of *Pinching* be performed on the tender Shoots; because having just Sap enough for themselves, when they come to put forth more Branches in the Place where they were *pinched*, the small Stock of Sap allotted them being divided will starve them.——The Operation is performed within two or three Eyes of the Branch they grow out of.

The Effect of *Pinching* is, that instead of one useless, perhaps, hurtful, Wood-branch, a vigorous Tree will put forth two or three at the Eyes remaining; and the Sap being thus divided, the Branches may be less, and fit for Wood and Fruit.

PULSES, **SALLET**, &c. are one of the principal Furniture of the Kitchen Garden.

SALLET, or *Sallad*, is a Dish of eatable Herbs ordinarily accompanying roast Meat, composed chiefly of crude fresh Herbage, seasoned with Salt, Oil, and Vinegar.

(*Menage* derives the Word from the *Latin*, *Salata*, of *Sal*, Salt; others from *Salcedo*: *Du Cange* from *Salgama*, which is used in *Ausonius*, and *Columella* in the same Sense.)

Some add Mustard, hard Eggs, and Sugar; others, Pepper, and other Spices, with Orange-peel, Saffron, &c.

Some define *Sallet* more generally, a Composition of Plants and Roots, of several Kinds to be eaten either raw or green, blanched or candied, by themselves, or mixed with others; and even, occasionally boiled, pickled, or otherwise prepared and disguised, to render more grateful to the Palate.——But this Definition includes Pot-herbs, &c. which the Generality of Authors deny to be any proper *Salleting*.

The principal *SALLET-herbs*, and those which ordinarily make the Basis of our *English Sallets*, are Lettice, Sellery, Endive, Cresses, Radish, and Rape, &c. Along with which by way of Furniture, or Additionals, are Purslane, Spinage, Sorrel, Tarragon, Burnet, Corn-sallet and Chervil.

The different Tastes of Mankind will not allow any certain Mixture of these to be prescribed as most agreeable; but, still, in mixing them, the Relish of the several Herbs is to be considered: Those for Instance, which are most hot and biting; as Cresses, Mustard, Sellery, Tarragon, Chervil, &c. with those that are more cool and insipid to Taste; as Turneps, Rape, Spinage, Lettice, Corn-sallet, Purslane, &c. By this Means the Herbs may be so judiciously mixed, that the too strong Taste of one Kind may not overpower all the rest; and the insipid Kinds be directly used to moderate and qualify the Heat and Pungency of the others, as the Season of the Year is more hot or cold; so as every *Sallet* may not only be agreeable to the Taste, but also Physick to the Body.

The Gardeners call *Small-Herbs*, in *Sallets*, those which should always be cut whilst in the Seed-leaf; as Cresses, Mustard, Radish, Turnip, Spinage, and Lettice: All which are raised from Seeds sown in Drills or Lines, from the Middle of *February* to the End of *March*, under Glasses or Frames, and thence to the Middle of *May*, upon natural Beds, warmly exposed; and during the Summer Heats, in more shady

shady Places; and afterwards, in *September*, &c. as in *March*, &c. and lastly in the Rigour of the Winter, in Hot-beds. If they chance to be frozen in very frosty Weather, putting them in Spring-water two Hours e're they be used, recovers them.

In gathering small Herbs, the best Way is to pull them up by the Roots from the Hot-bed. If the Roots be left, and a second Crop of *Salleting* sown on the same Bed, it will not prosper.—In sowing second Crops it is to be observed, that Seeds of the same Kind, be not sown in the same Place; but the Ground is to be eased by varying its Burden, putting hot Seeds where cold ones grew before, &c. Another Rule is, that no Plant be placed in the same Spot where the same Kinds have grown before.

Winter *Sallets* are greatly improved by blanched Sellery, which is a hot Herb of a very rich Flavour; raised from Seed sown in *March* and *April*, in a well exposed Place, and transplanted six Weeks after its first Appearance, into Beds, where it remains till the Middle of *June*, and then planted in Trenches, eight or ten Inches wide; and as many deep, first pruning off the Tops and Roots. As they grow large, they are to be earthed up, within four or five Inches of the Top, which is repeated several Times, till they be fit for Use.—Endive blanched, is much used in Winter *Sallets*, though it have neither Taste nor Flavour; it is cultivated much after the Manner of Sellery.—Of Lettice there are various Kinds, the best are the *Roman*, *Dutch* brown, *Imperial*, and *Silesia* Kinds, all which cabbage well. They are commonly sown with other Crops in *March*, for Summer *Sallets*, and in *August*, to be transplanted, or *September*, to stand the Winter; either to be cut for Winter *Sallets*, or to cabbage early next Spring for Seed.

For the additional, or secondary *SALLET-herbs*: Burnet is a cool perennial Herb, whose tender Leaves, mixed with other Herbs in the Winter, give the agreeable Flavour of a Cucumber: It is propagated by Seed, sown in *March*. Corn *Sallet*, raised at the same Time, and in the same Manner, makes a good Winter *Sallet* Furniture; Purslane, an insipid, yet cooling Herb: is admired by some in Winter *Sallets*: It is raised by Seeds, sown in *March*, in a warm Place.—Sorrel is chiefly used in the Spring; when the young Leaves are very agreeable. It is raised from Seeds, sown in *March*, usually in Drills or Rows. Spinage is a necessary Ingredient in raw *Sallets*, to be cut in the Ear-leaf; but it is better for boiled *Sallets* in the Winter, or Spring. It is sown in *March*, *April*, or *May*; and again in *August*, in a Place well exposed to the Sun, that the Leaves may be large enough for boiling in the Winter.—Tarragon, of all others, should never be wanting; it is a cordial Herb, though not the most agreeably tasted; yet a few Leaves, or three or four of the tender Tops, give a *Sallet* a good Relish. It is propagated from Slips, taken from the Root, and planted in *March*.—Note, in the Spring, Dandelion blanched, which is gathered in almost every ploughed Field, makes an excellent *Sallet*, mixed with other Herbs. Some

likewise gather Violet Flowers, Cowslips, and Blossoms of Burrage, as Part of the *Sallet* Furniture; others, Fennel, and Parsley.

Dressing of SALLETs.—The Sellery and Endive are to have their hollow, green Stem, or Stalk, stripped of all its outside Leaves, and sliced in the blanched Part, cutting the Root into four Parts. The other ingredient Herbs being exquisitely culled and cleansed of all faulty Leaves, &c. are washed rather by sprinkling than fobbing them in Spring Water, laid to drain off all superfluous Moisture, then shook and squeezed together gently, in a coarse Cloth, to dispose them to receive the Seasonings, viz. the Salt, Vinegar, Oil, &c. The Oil not to be yellow or high Coloured, but of a pale Olive Green, without either Taste or Smell. The Vinegar perfectly clear, neither sour nor palled. The Salt to be the best, ordinary Bay-salt, clean, bright and dry.

Some indeed recommend the essential Salts and Spirits of Vegetables, or those of the alcalizate and fixed Kind, extracted from the Calcination of Balm, Rosemary, Wormwood, &c. and affirm, that, without eating the gross *Sallet* Herbs themselves, we might have healing, cooling, generous *Sallets*, wholly out of the Salt-seller.

Note, in the Proportion of Salt, Pepper, and Vinegar, Regard is to be had to the Season, Constitution, &c. the two first being best for cold, the second for hot Stomachs, and Seasons.—For a moderate Exaline, or *Sallet*-vehicle, to three Parts of Oil, put one of Vinegar, or Lemon, or Orange Juice, and in the Mixture, steep Slices of Horse-radish, with a little Salt; occasionally add a little Guinea Pepper, and Mustard, with the Yolks of two Eggs boiled, squeezed, and bruised into a Mass therein; pour the whole on the Herbs, stirring and mingling them till they be thoroughly imbibed.

We conclude the Art of *Gardening* by these Observations, that the *Sieur le Nostre* first carried *Gardening* to any Thing of Perfection: *M. la Quintinie* has gone yet farther. nor have our own Countrymen or late been wanting to its Improvement; as *London*, *Wife*, *Bradley*, *Laurence*, *Fairchild*, &c.

M. Fatio has lately applied mathematical Reasoning to *Gardening*, and shewn how to make the best Use of the Sun's Rays in *Gardens*.

We forbear to say any Thing about the Antiquity or Usefulness of *Agriculture*; every Reader's Imagination will supply that Defect.—It has been cultivated by many of the greatest Men among the Antients, as Emperors, Dictators, and Consuls; and has been treated of by some of their greatest Authors, *Virgil*, for Instance, *Cato*, *Varro*, *Columella*, *Constantine*, *Porphyrogenitus*, *Palladius*, &c.

The late Authors in *Agriculture*, are *Baptista*, *Porta*, *Hersbachius*, and *Agricola*, in *Latin*; *Alphonso*, *Herrera*, in *Italian*; *Quintinie*, *Stephens*, *Liebaud*, *de Serrée*, *de Croiscens*, *Bellon*, *le Notre*, and *Chomel*, in *French*; and *Nourse*, *Evelyn*, *Mortimer*, *Switzer*, *Bradley*, *Laurence* and *Miller*, in *English*.

A L C H Y M Y.

ALCHYMY is a supposed Art, which Avarice, and the inordinate Desire of growing immensely rich at once, hath fancied to be founded on the best and most infallible Principles, for a true Investigation or Research of Nature's most hidden and mysterious Secrets, and Operations; though but few of them have been yet reduced into Practice.

That Art hath three principal Objects; 1. The Transmutation of Metals. 2. The Discovery of an universal Medicine, which could cure all Diseases. 3. That of an universal Dissolvent, or *Alkabeft*. Tho' none of the three hath ever tickled so

much the Curiosity of the most famous *Alchymists*, as that of the Transmutation of Metals, which some of the most insatuated among them, have dignified with the Title of *Grand Œuvre*, or Work by way of Excellence; because, perhaps, it hath cost some of them more Money in endeavouring to discover that Grand Nothing, than ever any Body, but those who have worked at it, could imagine; since the *Artists* themselves, especially those who had not made yet an entire Divorce with their Reason, have been obliged to confess at last; that after an indefatigable Labour, and immense Expences, instead of finding the Secret

cret to change the most imperfect Metals into Gold, they, on the contrary, have only found the ruinous one, of changing Gold into nothing. This was the sincere and ingenuous Confession of *Penotus*, who, after he had spent the greatest Part of his Life, and a very considerable Fortune, in the Research of the Philosopher's Stone, and being reduced to the greatest Poverty, was forced to end his Days at the Hospital of *Yverdun* in *Switzerland*; protesting at his Death, that if he had one Enemy in the World, he could wish him no greater Misfortune, than that of being infatuated with the ridiculous Notion of the Philosopher's Stone.

Monsieur l'Emery, a famous Apothecary and Chymist, in the Reign of the late King *Lewis XIV*, don't suppose the Discovery of that Secret, of the Transmutation of Metals, absolutely impossible, but says, that among the vast Number of Artists he knew, or heard of, who had attempted it, none had ever succeeded; which is enough to deter others from following so destructive an Example. That the greatest Part of those *Alchymists* were nothing else but Impostors and Juglers, pleased with the Opportunity of making an Advantage of the too great Credulity of some Persons, really infatuated with the ridiculous Notion, and the Infallibility of the Principles, those Juglers themselves knew very well to be false.

Myself have known Artists of those two Classes; some, who, after many Disappointments in the Research of their mysterious *Powder of Projection*, and after having quintessenced their Estate, their Substance, and their very Cloaths, persisted still in their former Obstinacy, that the Transmutation of Metals, was, not only possible, but that they were sure to succeed therein; to have objected against, had been an Offence of the highest Nature.

I have likewise known some others, who though, in all Appearance, as obstinate and as infatuated, as those before mentioned; nevertheless, it was easy to discover that their Obstinacy on that Subject, went no further than it could be subservient to their interested Views; that they had been very sorry, to spend any thing of their own, in their Researches; and would be Artists no longer than they could find Fools to answer their vexatious Demands, and defray their extravagant Expences. An *English* Benedictine Monk, Procurator, or Steward of their Convent at *Paris*, was an Artist of that Stamp. He found the Secret to persuade his Brethren, that he could, with the Help of *Alchymy*, an Art he was entire Master of, multiply *ad infinitum*, a considerable Sum of theirs he had in his Hands. The honest Steward went to work, and pretended to do so, while the Money lasted, the greatest Part of which, he lavished another Way, till being brought to an Account, the Monks finding their Store, instead of that vast Increase they had been flattered with, entirely evaporated, had the Artist committed for three or four Years to *Alenor's* Tower, at the *Bastile*, from whence he found at last the miraculous Secret to escape; and coming into *England* found some other Fools, who employed him also for a considerable Time, in the Research of the Philosopher's Stone, which at this present Time, is as far from him, as it was when he went first in Quest of it; though, if we would believe him, he don't despair of finding it still.

Another of those Impostors, a *French* Man, would have persuaded a noble Duke, nine or ten Years ago, that he could extract a considerable Quantity of Silver from the Tin of some Mines his Grace hath in *Cornwall*, pretending that he had made some Experiments of it, shewing even the Duke some Silver, which he was credulous enough to believe, was extracted from that Tin; in consequence thereof, the Artist was to transport himself on the Spot, to work under the Direction, and at the Expences of his noble Master; who had no sooner clothed him, and provided him liberally with Money for his Journey; than the expert Artist, mistook the Road of *Holland*, for that to *Cornwall*, and hath never been heard of since.

Another of his Countrymen has followed lately his good Example; the poor Gentleman had been here several Years looking for some Bubble, and was almost quite out of Hope of Success; when unexpectedly he found one fit for his Purpose. The Gentleman tantalized with the Expectation of an immense Gain, received the Artist into his House, and begun by covering his coarser Substance, almost alcoholized, and in the same Condition, the first *Alchymist* *Adam* was, in the State of his Innocency; he was also supplied with Money for the necessary Preparations to be made, for that grand Operation. Accordingly a Vial was filled with something, and put in Digestion, in Horfes Dung; and was to remain there a whole Year, at the End of which, the Powder of Projection, it was to produce, would be fit for Use; but before the Year was elapsed, the Artist, who in that Time had found the Secret to make up a pretty considerable Purse, disappeared, leaving to the Projector, the whole Care of the Bottle.

The greatest Artist of this Kind, was the famous *Laws*, who in 1718. found the Secret in *France*, to change Paper into Money, Money into Paper; and at last Paper into nothing.

Jugglers, who, by Dexterity of Hands, play a great many very diverting and surprising Tricks, called by the *French* *des Tours de Passe, Passe*, as when they fix the Mercury with Verdigrease, or by fixing a small Quantity of Silver at the End of the iron Rod, with which they stir the Matter in Infusion increase it, and make the Spectators believe, that the Powder they have thrown into the Crucible, has occasioned that Increase, are the more honest of the two; since they give the Curious something for their Money; but the others are unsufferable, and those that employ them true Bedlamites.

But however, let us suppose, for once, with *Monsieur L'Emery*, that the Discovery of the Philosopher's Stone is possible; and for once speak like an Artist.

Was I to follow my real Opinion on this Subject, the PHILOSOPHER'S STONE should be defined by me, a certain grand *Nothing*, very much wished for, long and often sought for, and never to be found; but as I must appear in this Place prejudiced in its Favour, as such,

The *Philosopher's Stone*, is a Preparation for the *Transmutation* of the most imperfect Metals, into perfect ones.

This *Transmutation*, is to be attempted three ways; by Separation, Maturation, or real Transmutation.

If we can reasonably suppose, that all other Metals, even the less perfect, contains some Quantity of Gold, more or less, this Operation may be effected by Separation. Those that stand for the Affirmative, don't question in the least, but there is Gold in all other Metals, but to so small a Quantity in some of them, that it would not defray the Expences of the Separation. For my Part, I cannot be of that Sentiment; since that Quantity of Gold could be found in the different Preparations, the *Chymists* are obliged to make of those imperfect Metals, as in their Fusion, Crystalization, Distillation, Sublimation, &c. &c. without any other additional Charges, since Gold, being not sensible of the same Mutations, and once freed from the heterogeneous Bodies it was wrapt in, would be found left by itself; though no *Chymist* has been pleased to inform us yet, that he hath ever made that advantageous Discovery.

None but *Mercury* could be changed into Gold by Maturation; the Principles of all other Metals being not pure Mercury, and the Abundance of heterogeneous Particles, and the small Quantity of imperfect ones, which enter into their Composition, is confounded with, cannot be separated from it, by a Digestion.

Mr. Chambers is pleased to suppose, that in the *Maturation* of *Mercury*, its Impurities being lighter than Mercury itself, if once purged of those Impurities, it could easily be changed into Gold; because it would be then as heavy as Gold; but that's but a very frivolous Reason to assert the Possibility of that *Transmutation*.

mutation; since Weight is not the essential Quality constitutive of that perfect Metal; the Artist should also find the Secret, to render the *Mercury*, thus freed of its Impurities, ductile and malleable, by making its Parts to have the same Attraction, and cohere with the same Force; which could scarce be perfected, since it would be almost impossible to render *Mercury* as free from Sulphur, as is Gold: But the most essential Quality is, that Mercury should equal Gold in its Fixedness in the Fire, resulting from the Homogeneity and Equality of its Parts, which all have equal Pores or Interstices, through which the fiery Corpuscles find an easy Passage, and therefore cannot hasten its Fusion, with the same Facility, as that of less perfect Metals; where, through the Obliquity and unequal Position of their Pores, they meet with more Resistance: I confirm this Sentiment by an undeniable Fact, which happened in *Holland*, towards the Middle of the last Century.

Longueville, a *Frenchman*, had found the Secret of that Metal, which, Mr. *Chambers* supposes, would be pure Gold; nay, he had even carried it to a greater Perfection than Mr. *Chambers* seems to desire, since, besides the Weight, *Longueville's* Metal had, in all Appearance, all the other Qualities of real Gold; till being put to the Crucible, its Pores being not in the same Position, nor at the same equal Distance, it evaporated into Smoak. This *Longueville's* Gold cannot be supposed to be any Thing else but a Preparation of *Mercury*, as prescribed by Mr. *Chambers*.

The *Transmutation* of Metals, which is the third Method pretended to be used by the *Alchymists*, should be done, as they say, by melting them in the Fire, and casting some Quantity of a Powder, called by them *Powder of Projection*, unto the fused Matter, upon which the Fæces immediately retire, are vitalized and burnt, and so carried off; and the rest of the Mass changed into pure Gold. But if such Method be practicable, is what at all Times, and in all Ages, hath been much controverted.

Cardan, and some others, will have the Transmuting other Metals into Gold, or Silver, utterly impossible; because, say they, it being absolutely necessary, that in such Operations, those Metals should be calcined, they never can afterwards, be brought again to their pristine Purity; besides the Generation, required in such Case, which is not the Work of Art, but of Nature. The same Authors even deny the Possibility of changing imperfect Metals into others the like imperfect; as Iron into Brass, or Copper; and Lead into Tin.

This Opinion squares very well with mine, for unless an ADVERT could persuade me, that in his Transmutation, he can perfectly imitate Nature in the Formation of the *Marcasite*, in its *Matrux*; that his Arts can furnish him with some infallible Rules, for the Direction of his Fire, whereby he can bring it to a Degree of Heat, equal to that of the *Sun* in those Climates where Gold is formed; he'll find me always equally prepossessed with the same Incredulity and Obstinacy. M. *Emery* himself, should have resolved those Difficulties, before he could have convinced me, that the Transmutation of Metals was possible, he should have produced Examples to prove it; for if it is possible, why, after so assiduous an Application to it, and so much Labour, have we not been able to find it yet? Is Art less industrious in this, and more sterile in Inventions, than it has been in an infinite Number of its Operations, in which it hath so well imitated, if not rivaled Nature herself? Why so many Directions and Rules in vain, and in all Appearance, so just and so well calculated; though when reduced to Practice, they prove ineffectual?

An *Alchymist* would answer to this, that a great many Artists have conducted their grand Operation with such Success, as to bring it to that Crisis, that it wanted but a lucky Moment, to have it perfected. That's almost such a ridiculous Story, as was that of *Fryer Bacon's* brazen Head.

Time had been, in which the monstrous Prodigy could have appeared, if it had been minded, but that lucky Moment was so long a coming; and when come, did run with such Velocity, that it was impossible to lay hold of it.

Likewise, *Transmutation* had been effected, if the Artist had been more attentive; but for want of that Attention, the Operation hath miscarried, and it must be begun a-new; and SUBTLE must be supplied with more Money, by some Tribulation or Ananias, who have been cozened of their Senses, as well as of their Money, by the Impostor; who, to give a greater Notion of his pretended Capacity, expresses himself in a Dialect, which neither he, nor any Body else understand; giving to their Metals a Name quite different from that whereby they are known to the *Naturalists*; calling Gold, *Sol*; Silver, *Luna*; Iron, *Mars*; Copper, *Venus*; Lead, *Saturn*, &c.

What's the more surprizing is, that some of those *Alchymists*, not contented with searching what they call the Seed of Gold in less perfect Metals, look for it in Mixts or Substances, where's the less Appearance it could be found, as in Plants, in the Blood, Hairs, and even in the Excrements; and work upon it with as much Success; as they do upon Metals.

Mr. *Boyle*, (let it be said with all the Veneration I have for his profound Knowledge and Experience) seems to have been of that Opinion, and would have us believe, that even Rain Water is not deprived of that valuable Seed, since he assures us, in his *Scept. Chymist*, That Rain Water being distilled and redistilled, that is to say, if we speak the Language of the *Alchymists*, after a great Number of *Cobinations*, which he computes at 200, did leave at the Bottom of the *Alembick*, a considerable Quantity of white Chalk, or Earth; and that more plentifully in the latter Distillations, than in the former; which Chalk he leaves us to judge, could be changed into Gold; perhaps with the Help of the miraculous *Powder of Projection*.

But what is that *Powder of Projection*, that great Arcanum, capable to produce so extraordinary a Mutation? Whence does it come? And how does it work?

Ask an *Alchymist*, what is *Powder of Projection*; and he'll answer, that *Powder of Projection* is *Powder of Projection*, i. e. a Powder which hath the Power of changing any imperfect Metal, into a more perfect one, by the Admixture of a little Quantity thereof. If you want a more explicit Definition, you must make it yourself, or be contented with this, since the greatest Artists have not been yet capable to express themselves in Terms more significative or satisfactory.

They would be as much puzzled to trace the Origin of that Powder, as to find out its first Inventors; as for the Manner it operates, it is as well a Secret to themselves, as to any Body else; and it may be as skilfully prepared by a Person who hath never studied the Hermetick Art, as by one, who, all his Life-time, hath been buried in the Ashes of a *Furnace*, and produce the same Effects.

This Art, however, is not equally contemptible in all its Branches; since we know by Experience, that some Artists have found, by an assiduous and indefatigable Labour, if not the Secret of the Transmutation of Metals; some others, which from Time to Time have proved very beneficial to Mankind, as some general Remedies, which they have dignified by the Title of *Universal Medicine*; and sometimes called the *Grand Elixir*, which cure all Diseases. That *Elixir*, in the Opinion of the *Alchymists*, coincides with the *Philosophers Stone*, so what will make Gold will also cure all Diseases.

Kircher assures us, that the ancient *Egyptians* had a very good Notion of that *Elixir*, which for its Subtlety and Perfection, they called *Heaven*; and which they used to draw from the hardest and most precious Substances. This he takes to be that admirable

mirable and celestial Water, capable of removing all Diseases.

A great many since, have pretended to be Masters of that inestimable Secret; *in lieu* whereof, they have made Use of some poisonous Medicine, the Product of their vitiated Imagination, which seemed to have been found out for the entire Extirpation of human Race; or which they have found, perhaps, in some old Books of *Receipts*, and which they administer without Experience or Skill: All Nations and Countries have been pestered with those *Impostors*, *Quacks*, and *Charlatans*, England not excepted; which, at this present Time, sees its Inhabitants flock to one of them, who, through an unexpected Success, in the Distribution of a certain *Nostrum*, he hath pirated somewhere, and which he administers as a *Grand Elixir*, without Skill or Knowledge, for all Diseases, hath acquired a Reputation, which his too frequent Murders should have Tarnished; if the too great Credulity, and ridiculous Infatuation of the *Vulgar*, was not a second Nature, seldom to be conquered, even by the clearest Demonstration, or Evidence. The specious Pretext of a Christian Charity, serves, often, in those Occasions, to strengthen the Rabble in their Obstinacy: And a *Charlatan* is never blamed for killing his Patients *Gratis*.

I have known an *Emperick*, of a quite different Character, who having found himself, by a serious and continual Application to *Alchymy*, an *Elixir*, which he called the *Tincture of Gold*, used to administer it with a great deal of Skill and Judgment, and surprizing Success; for we cannot deny the Possibility of finding such Secret, which could cure all Diseases; and which we will prove, when we treat of Medicine in general.

Chymistry and *Pharmacy* are indebted to *Alchymy*, for many other useful Discoveries of that Kind; so that the Hermetick Art hath not been always oppressive to the Commonwealth; especially when practised with Skill and Judgment; for if the *Artist* miss finding what he was looking for, he often discovers in that Research, what is more advantageous to Society, than the *Transmutation* of Metals, a *Specifick*, which cures effectually, and sooner, a *Chronick*, or some other dangerous Malady, than a *Galenical*, or other Preparations, used by our *Ancestors*, when we had but a confused Idea of *Alchymy*, and is preferable to a Secret, which once found, would only serve to foment and flatter one of our most criminal Passions, Avarice.

Some of the *Juggling Alchymists*, when they have kept their *Bubbles*, long in Suspence, and in the Expectation of seeing every Day the Accomplishment of their Wishes; conscious that their Imposture must be discovered at last, by the Miscarriage of their Project, and afraid of the dangerous Consequences such Miscarriage may be attended with, leave the *Philosophers Stone*, where it hath been so long hidden; and flatter their *Dupes*, with the Hope of another Discovery, which they promise will prove as beneficial to the *Society*, as the *Transmutation* of Metals.

One of those *Impostors* made a very good Use of that specious Pretext, towards the Beginning of the late Queen *Anne's* Reign, to extricate himself out of the Labyrinth he had entered into; finding that he could wear the Mask no longer, and that his Imposture was on the *Point* of being discovered, excused himself to those who had set him to work, on his having missed the lucky Moment, in which the *grand Operation* was to have been perfected; but that if they would continue to encourage him, he had found a Secret in his Research of the *Philosopher's Stone*, which would make a Compensation for their past Expences, and which was the making of Gun-powder out of human Excrements, far preferable to that made of common *Salt-petre*. The Projectors, who had already more than a sufficient Reason to suspect the Truth of all he could say, even the most plausible; loth, however, to have sunk so much Money to no Purpose, approved also this second Scheme; and

the *Artist* having contracted with the most considerable of his Brethren, the *Gold-finders* of the City of *London*, and its Suburbs; took a House at *Hammer-smith*; and went chearfully to work, though not quite to the Satisfaction of his Neighbours, who often complained of him as a publick Nuisance; but however, he found himself at last, in a Capacity of performing his new Covenant, and sent to the Tower a *Gun* of Gun-powder of his Invention, which, in Fact, was very good; with this small Difference, only, that it cost a great deal more than the common Gun-powder, and would not defray the Expences the Undertakers had been at for the making it: Therefore the too skillful *Artist* was dismissed.

The last Object of *Alchymy*, is to find out an Universal Dissolvent, which they call *Alkabeft*, whereby they pretend to resolve all Bodies into their first Matter, Water alone excepted.

'Tis the real Opinion of *Paracelsus*, and *Van Helmont*, that there is a certain Fluid in Nature, capable to reduce all sublunary Bodies, as well homogeneous, as mixed, into their first Principle, or original Matter they are composed of; or into an uniform, equal, and potable Liquor, that will unite with Water, and the Juices of our Bodies, yet retain its seminal Virtues; and if mixed with itself again, thereby be converted into pure elementary Water.—Whence they imagine, it would at length reduce all Things into Water.

Van Helmont protesting that he was himself Master of that noble *Mensstruum*, hath excited the Curiosity of all the succeeding *Alchymists*, in the Pursuit of it. Mr. *Boyle* had conceived so advantageous an Opinion of it, on the single Report of *Helmont*, that he is pleased to assure us, that had he ever been so happy as to find it, he had preferred it to the *Philosopher's Stone*; so would I, since there is not so great an Absurdity in the Notion of an universal *Ens*, that resolves all Bodies into their *Ens* genial, by freeing them of the heterogeneous Particles they were wrapt in, and thereby restore them to their pristine Liberty of directing themselves, as there is to believe, that at the same Instant they are thus freed, they acquire another Form, without the Allowance of the least Moment for a new *Direction*.

No Question, but all Bodies arise originally from a first Matter, which was once in a fluid Form, whose Particles, by the continual Agitation and Compression of the *Atmosphere*, the Diversity of their Figures, and the occult Quality, which direct them to their different Poles, have been concatenated together, for the Formation of those different Bodies.

Pantaleon, *Philalethes*, *Tachenius*, *Ludovicus*, &c. have left us several Treatises on the Subject of the *ALKABEST*, which they thought worthy their most serious Application.

Paracelsus, if we believe *Helmont*, was the first Inventor of the Term *Alkabeft*; in Fact, we don't find it before his Time, in any other Author; *Paracelsus* himself hath mentioned it but once, and that in his second Book *de viribus membrorum*.—*Est etiam ALKABEST Liquor*, (says he, treating of the Liver) *magnum hepatis conservandi, & confortandi, &c.*

"There is, also, the Liquor *Alkabeft*, of great Efficacy in preserving the Liver; as also in curing hydropical, and all other Diseases, arising from Disorders of that Part. If it have once conquered its like, it becomes superior to all other hepatick Medicines; and though the Liver itself were broken and dissolved, this Medicine should supply its Place."—Though, begging Mr. *Paracelsus's* Pardon, I would not be forced to make the Experiment: For he may as well tell me, that his *Alkabeft* would restore a dead Man to Life; which is more than our modern *Helmont*, *WARD*, hath pretended yet.

From the common Practice of *Paracelsus*, to transpose the Letters of his Words, as when he writes *Sustratar*, for *Tartar*; for *Nitrum*; *Mutrim*, &c. some Authors imagine that his *Alkabeft* is formed of *Alcali-est*,

est, and consequently, was nothing else but the alkaline Salt of Tartar volatilized. Glauber seems to be of that Opinion. Others will have it the German Word *Algeist*, wholly spirituous and volatile. Others take it from *Salz-geist*, which signifies Spirit of Salt; in Fact, Spirit of Salt was the great *Menstruum Paracelsus* used on most Occasions.—The Commentator of *Paracelsus*, who gives a Latin Edition of his Works at Delft, assures us, that the *Alkabeft* was a Mercury converted into a Spirit.—*Zwelfer* judged it to be a Spirit of Vinegar from Verdigrease.—And *Starkey* thought he discovered it in his Soap.—The elder *Helmont* mentions the *Alkabeft* by the compound Name of *Ignis-aqua*, Fire-water; from its Property of consuming all Things, and on Account of its liquid Form.—He also intitles it, *Summum & felicissimum omnium Salium*, “the highest and most successful among Salts; which having obtained the supreme Degree of Simplicity; Purity and Subtility, alone enjoys the Faculty of remaining unchanged, and unimpaired by the Subject it works upon, and of dissolving the most stubborn and untractable Bodies; as Stones, Gems, Glass, Earth, Sulphur, Metals, &c. into real Salt, equal in Weight to the Matter dissolved; and this with as much Ease, as hot Water dissolves Snow.—This Salt, continues he, by being several Times cohobated with *Paracelsus’s* *Sal circulatum*, loses all its Fixedness; and at length becomes an insipid Water, equal in Quantity to the Salt it was made from.”

From thence we may easily draw this Inference, that *Paracelsus*, as well as *Van Helmont*, took Water for the universal Instrument of Chymistry and Philosophy; and Earth for the unchangeable Basis of all Things; that Fire was designed as their efficient Cause; that seminal Impressions were lodged in the Mechanism of Earth; and that Water, by dissolving and fermenting with the Earth, as it does by Means of Fire, brings every Thing forth; whence originally proceed the animal, vegetable and mineral Kingdoms. Even Man himself being thus originally created; and as easily dissolved into his *Ens Primum*, as to his natural Substance, abstracted from his spiritual one, which, though created, cannot return into his *Ens Primum*, otherwise than by his strict Re-union to him.

The *Alkabeft* operates in the five following Ways.

1. The Subject, exposed to its Operation, is converted into its three Principles, Salt, Sulphur, and Mercury; afterwards into Salt alone, which then becomes volatile; and at length is wholly turned into an insipid Water.—The Manner of Application is by touching the Body proposed to be dissolved, *ex. gr.* Gold, Mercury, Sand, or the like, once or twice with the pretended *Alkabeft*; and if the Liquor be genuine, the Body will be converted into its own Quantity of Salt.

2. It does not destroy the seminal Virtues of the Bodies dissolved thereby.—Thus Gold, by its Action, is reduced to a Salt of Gold.—Antimony to a Salt of Antimony; Saffron to a Salt of Saffron, &c. of the same seminal Virtues, or Character, with the original Concrete.—By seminal Virtues, *Helmont* understands those Virtues which depend upon the Structure or Mechanism of a Body, and makes it what it is. Hence an actual and genuine *aurum potabile*, might readily be gained by the *Alkabeft*, as converting the whole Body of Gold into Salt, retaining its seminal Virtues, and being withal soluble in Water.

3. Whatever it dissolves, may be rendered volatile by a Sand-heat; and if after volatilizing the Solvend, it be distilled therefrom, the Body is left pure insipid Water equal in Quantity to its Original self, but deprived of its seminal Virtues.—Thus if Gold be dissolved by the *Alkabeft*, the Metal first becomes Salt, which is potable Gold; but when the *Menstruum* by a farther Application of Fire is dissolved therefrom, it is left mere elementary Water, whence it

appears, that pure Water is the last Production or Effect of the *Alkabeft*.

4. It suffers no Change or Diminution by dissolving the Bodies it works on, and therefore sustains no Re-action from them, being the only immutable *Menstruum* in Nature.

5. It is incapable of Mixture, and therefore remains free from Fermentation, and Putrefaction; coming off as pure from the Body it hath dissolved, as when first put thereon, without leaving the least Foulness behind.

These are the Properties attributed to the *Alkabeft*, if ever by an unexpected good Luck, some Artist was to discover a Dissolvent of that Kind; which, though possible, is however hidden yet, somewhere, with the Philosophers Stone, since the Commentator of *Paracelsus*, and *Van Helmont*, don’t appear to be very well convinced, that *Paracelsus* was Master of a real and true *Alkabeft*; the one pretending that it was some mercurial Preparation, and, the other, nothing else but the Spirit of Salt, which last, though we are Masters of, cannot produce those surprizing Effects attributed to the *Alkabeft*.

Some Authors pretend, but upon what Foundation I know not, that *Alchymy* is as antient as the World; that *Adam* was the first *Alchymist*, as well as our first Parent; but how he acquired that profound Knowledge, if by *Infusion*, or by eating the prohibited Fruit, or after his Expulsion from the Garden, or by being condemned to get a Livelihood by the Sweat of his Brows, he thought he could never better obey that Order, than by looking after what was not to be found, or poring over an *Alembick* or a Crucible, is what *Moses* has kept a Secret.

It is true, that almost all the Philosophers agree, that *Adam*, from the first Instant of his Creation, had the Philosophy by Infusion; *i. e.* that he had a perfect Knowledge of all he was to know as a perfect Man; and of all that could contribute towards his temporal Felicity, till his divine Creator would be pleased to have it changed into an eternal one: But as that Knowledge was not without some Limitation (else the Serpent had not tempted *Eve* with the Promise of a more extensive one) and that he knew nothing, then, which could have excited the Tumult of his Passions, it is not reasonable to suppose, that *Adam* had the least Tincture of *Alchymy*, which owes its first Origin to *Covetousness*, a Passion capable to disturb the Tranquillity of *Adam’s* Mind, and which had not been known in the Garden of *Eden*.

Adam might have had, perhaps, some general Notion of Gold, but then he could not have considered it otherwise than as an Excrement of Nature, of no Utility or Service to him. What Use could he have made of it? Not to gain the Respect of his fellow Creatures; since he was then the only Man upon Earth, feared and respected by all other Creatures of an inferior Rank. To purchase Estates? He was then sole Possessor, Sovereign, and absolute Master of the whole World. To adorn himself, or his Wife *Eve*, embellish his Palaces, &c.? They both knew, in those fortunate Days, no greater Ornament than that of their Innocency. They had then, all they could wish for, without Pains, Trouble, or Inquietude, and could have wished for nothing else.

Besides, if *Adam* had wanted Gold, he must have known where to find it, without having Recourse to laborious Researches, which his profound Knowledge could have told him were vain and fruitless.

But *Adam*, perhaps, became, or rather turned *Alchymist*, after his Understanding had been darkened, and his Senses depraved by his Sin, which would be the more plausible; though we don’t find in *Holy Writ*, that any of the antient Patriarchs, had the least Knowledge of Metals, before *Tubal-Cain*.

If *Moses* be the *Trismegistus* of the Antients, he might have been an *Alchymist*; for if any Body hath ever been Master of the Philosopher’s Stone, *Moses* must,

must; where could he have found else, that immense Quantity of Gold the *Israelites* were possessed of in the Desert? For it is not reasonable to suppose, that it rose from the Spoils of the *Egyptians*, who could never have been persuaded to lend so much Wealth, on the single Pretence of a Feast; besides, we don't see that they had then, so advantageous an Opinion of the Probity of the *Hebrews*, who could never have borrowed on that Occasion, but of the few Friends they had in *Egypt*.

All this is but a mere Supposition confirmed by no Authority whatever; since we don't find any antient Poet, Philosopher, or Physician, from *Homer*, till 400 Years after *Christ*, mentioning any such Thing as *Alchymy*, whose Name, therefore, is not of so antient standing as pretended.—The first Author who speaks of making Gold, is *Zosimus*, the *Panopolite*, who lived towards the Beginning of the fifth Century, and has an express Treatise of the divine Art of making Gold and Silver, still extant in Manuscript in the King of France's Library.—The next is *Aeneas Gazeus*, another Greek Writer towards the Close of the same Century, in whom we have the following Passage. "Such as are skilled in the Ways of Nature, can take Silver and Tin, and changing their Nature, turn them into Gold." The same Writer tells us, "He was wont to stile himself Gold-melter, and Chymist."—Hence we may gather, there was some such Art in that Age; but as neither of these Authors relate how long it had been known before, their Testimony will not carry us back beyond the Age wherein they lived; contrary to *Suidas's* Opinion, who will have the Secret of the Philosopher's Stone couched in the Fable of the *Argonauts*.

Neither do we find any earlier or plainer Traces of the universal Medicine: Not a Syllable of any such Thing in all the Physicians and Naturalists, from *Moses* to *Geber* the Arab, who is supposed to have lived in the seventh Century. That Author in one of his Works, intituled the *Philosopher's Stone*, mentions "a Medicine which cures all Lepras." Some other Authors suppose, that this Passage has given the first Hint of the Matter; though *Geber* himself, perhaps, meant no such Thing: For by attending to the Arabic Style, and Diction of this Author, which abounds in Allegory, it appears very probable, that by Man he means Gold; and by Lepras, or Diseases, the other Metals, which are all impure in Comparison of Gold.

Suidas accounts for this total Silence of Authors, in Respect of *Alchymy*, by observing, that *Dioclesian* procured all the Books of the antient *Egyptians* to be burnt; and that in those all the great Mysteries of Chymistry were contained.—*Courtingius* calls this History in Question, and asks how *Suidas*, who lived but five hundred Years before us, should know what

had happened eight hundred Years before him? To which *Borrichius* answers, that he had learnt it of *Eudemus*, *Helladius*, *Zozimus*, *Pamphilus*, &c.

Kircher assures us, that the Theory of the Philosopher's Stone, is delivered at large in the Tables of *Hermes*; and that the antient *Egyptians* were not ignorant of the Art, but declined to prosecute it. They had no Need to transmute Gold, they had Ways of separating it from all Kind of Bodies from the very Mud of the *Nile*, and Stones of all Kinds. But he adds, that these Secrets were never wrote down or made publick; but confined to the Royal Family, and handed down traditionally from Father to Son.

The Chief Point advanced by *Borrichius*, and on which he seems to lay the greatest Stress, is the Attempt of *Caligula*, mentioned by *Pliny*, for procuring Gold by Distillation, from Orpiment; but this, it may be observed, makes very little for that Author's Pretensions; there being no Transmutation, no Hint of any Philosopher's Stone, but only a little Gold extracted or separated from the Mineral.

The principal Authors in *Alchymy*, are *Geber*, *Ripley*, *Lully*, *John* and *Isaac Hollandus*, *Basil Valentine*, *Paracelsus*, *Van Zuchten*, *Sendivogius*, &c.

Towards the Beginning of this Century, and under the Reign of the late King *Lewis XIV.*, two famous *Alchymists*, both *Capuchins* Fryers, appeared in France, protected by that great King, who took them into his Palace of the *Louvre*, from whence they have been called since, the *Capuchins du Louvre*, and had a magnificent Laboratory erected for them, where they used to work, not in the Research of the Philosopher's Stone, but for the Discovery of an universal Medicine, which could cure all Diseases, in which they succeeded so far, as to be Masters of several excellent Remedies, which since have proved very beneficial to Mankind.

The late Regent of France, the Duke of Orleans, if we believe the common Report, had a very advantageous Opinion of *Alchymy*, and as good a Notion of that Art, as any of the most famous ones heretofore mentioned; some even pretend that his Royal Highness had been himself a very skilful Artist; which, considering he was a Prince of a very profound Knowledge, and vast Capacity, could help to dissipate some of my former Prejudices against *Alchymy*.

The late King of Sweden, *Charles XII.* thought also the Transmutation possible; though his Majesty refused the granting his gracious Pardon to a Person, who proffered, on that Condition, to render *Charles* Master of that Secret, at that Time on his Expedition in Saxony; which being reported to *Augustus II.* answered, "That the King of Sweden had no Need of the Philosopher's Stone, since he had found it in Saxony."

ALGEBRA.

ALGEBRA, is a peculiar Kind of Arithmetic, which takes the Quantity sought, whether it be a Number, or a Line, or any other Quantity, as if it were granted; and by Means of one or more Quantities given, proceeds by Consequence, till the Quantity, at first only supposed to be known, is found to be equal to some Quantity or Quantities which are certainly known, and consequently it self is known.

ALGEBRA is of two Kinds, Numeral, and Literal.

NUMERAL, or vulgar *Algebra*, is that of the Antients, which had only Place in the Resolution of Arithmetical Questions.—In this, the Quantity sought is represented by some Letter or Character; but all the given Quantities are expressed by Numbers.

LITERAL, or specious *Algebra*, or the new *Algebra*, is that wherein the given known Quantities, as well as the unknown, are all expressed, or represented by their Species, or Letters of the Alphabet.

This eases the Memory and Imagination of a vast Stress, required to keep several Matters necessary for the Discovery of the Truth in Hand, present to the Mind.

Specious *Algebra* is not like the Numeral, confined to certain Kind of Problems, but serves universally, for the Investigation of Theorems, as well as the Solution and Demonstration of all Kinds of Problems.

Theorem is a speculative Proposition, deduced from several Definitions compared together.—Thus if a Triangle be compared with a Parallelogram, standing on the same Base, and of the same Attitude, partly from their immediate Definitions, and partly from

from other of their Properties already determined; it is inferred that the Parallelogram is double the Triangle, that Proposition is a *Theorem*.

There are two Things to be chiefly regarded in every *Theorem*, viz. the Proposition and the Demonstration: In the first is expressed what agrees to some certain Thing, under certain Conditions, and what does not.—In the latter the Reasons are laid down, by which the Understanding comes to conceive that it does not agree thereto.

Theorems are of various Kinds, Universal, Particular, Negative, Local, Plain, Solid, Reciprocal, &c.

Universal THEOREM, is that which extends to any Quantity without Restriction, universally.—As this, that the Rectangle of the Sum, and Difference of any two Quantities, is equal to the Difference of their Squares.

Particular THEOREM, is that which extends to any particular Quantity.—As this; in an equilateral right-lined Triangle, each of the Angles is sixty Degrees.

Negative THEOREM, is that which expresses the Impossibility of any Assertion.—As that the Sum of two biquadrate Numbers cannot make a square Number.

Local THEOREM, is that which relates to a Surface.—As, that Triangles of the same Base and Altitude are equal.

Plane THEOREM, is that which relates to a rectilinear Surface, or to one terminated by the Circumference of a Circle.—As, that all Angles in the same Segment of a Circle, are equal.

Solid THEOREM, is that which considers a Space terminated by a solid Line, that is, by any of the three conic Sections.—*ex. gr.* this; that if a right Line cut two asymptotic Parabola's, its two Parts, terminated by them, shall be equal.

Reciprocal THEOREM, is one whose Converse is true.—As that if a Triangle have two equal Sides, it must have two equal Angles: The Converse of which is likewise true, that if it have two equal Angles, it must have two equal Sides.

The Letters used in *Algebra*, do each separately represent either Lines or Numbers, as the Problem is Arithmetical or Geometrical, and together they represent Planes, Solids, and Powers more or less high, as the Letters are in a greater or less Number.—For Instance, if there be two Letters, *a b*, they represent a Rectangle, whose two Sides are expressed, one by the Letter *a*, and the other by *b*, so that by their mutual Multiplication, they produce the Plane *ab*. Where the same Letter is repeated twice, as *aa*, they denote a Square; three Letters, *a, b, c*, represent a Solid, or a rectangled Parallelepiped, whose three Dimensions are expressed by the three Letters *a, b, c*, the Length by *a*, the Breadth by *b*, and the Depth by *c*, so that by their mutual Multiplication, they produce the Solid *abc*.

The Power in *Algebra*, is the Produce of a Number, or other Quantity, multiplied into itself.

The Moderns, after *Des Cartes*, are contented to distinguish most of their Powers by the Exponents; as, *first, second, third, &c.*

The particular Names of the several Powers, were introduced by the *Arabs*; viz. *Square, Cube, Quadrato quadratum, or Biquadrate, Surdesolid, Square of the Cube, second Surdesolid, Quadrato quadrato quadratum, Cube of the Cube, Square of the Surdesolid, third Surdesolid, &c.*

The Names given by *Diophantus*, followed by *Vieta* and *Oughtred*, are, the *Side or Root, Square, Cube, Quadrato-quadratum, Quadrato-cubus, Cubo-cubus, Quadrato-quadrato-cubus, Quadrato-cubo-cubus, Cubo-cubo-cubus, &c.*

The Characters wherewith the several Powers are denoted, both in the *Arabic* and *Cartesian* Notation, are as follow:

	2	4	8	16	32	64	128	256	512	1024
<i>Arab.</i>	<i>R</i>	<i>q</i>	<i>c</i>	<i>bq</i>	<i>s</i>	<i>qc</i>	<i>Bf</i>	<i>iq</i>	<i>bc</i>	<i>sq</i>
<i>Cartes.</i>	<i>a</i>	<i>a²</i>	<i>a³</i>	<i>a⁴</i>	<i>a⁵</i>	<i>a⁶</i>	<i>a⁷</i>	<i>a⁸</i>	<i>a⁹</i>	<i>a¹⁰</i>

Hence to raise a Quantity to a given Power, or Dignity, is the same as to find the Factum arising upon its being multiplied a given Number of Times into itself: *e. gr.* to raise 2 to the 3d Power, is the same as to find the Factum 8; whose Factors are 2, 2, 2.

Powers of the same Degree, are to one another in the Ratio of the Roots as manifold as their Exponent contains Units: Thus Squares are in a duplicate Ratio; Cubes in a triplicate Ratio; Quadrato-quadrata, or fourth Powers in a quadruple Ratio.

The Powers of proportional Quantities, are also proportional to one another.

From a given Power to extract the Root or Side, is the same as to find a Number, *e. gr.* 2. which multiplied any Number of Times, *e. gr.* twice, produces the given Power, *e. gr.* the 3d Power, or 8.

To multiply or divide any Power by another of the same Root. 1. For Multiplication, add the Exponents of the Factors; the Sum is the Exponent of the Factum thus:

$$\begin{array}{l} \text{Factors } \left\{ \begin{array}{l} x^3 \quad y^m \quad y^m \quad a^m \quad x^n \\ x^4 \quad y^m \quad y^n \quad a^r \quad x^s \end{array} \right. \\ \hline \text{Prod.} \quad x^7 \quad y^{2m} \quad y^{m+n} \quad a^{m+r} \quad x^{n+s} \end{array}$$

2. For Division, subtract the Exponent of the Power of the Divisor, from the Exponent of the Dividend; the Remainder is the Exponent of the Quotient. Thus

$$\begin{array}{l} \text{Divid.} \quad x^7 \quad \left(x^7 \parallel y^{m+n} \right) \left(y^m \parallel a^m x^n \right) \left(a^m - y^n - 5 \right) \\ x^3 \quad \left(x^7 \parallel y^n \right) \left(y^m \parallel a^r x^s \right) \left(a^m - y^n - 5 \right) \end{array}$$

M. de la Hire gives us a very odd Property common to all Powers. *M. Carre* had observed with regard to the Number 6, that all the natural cubic Numbers, 8, 27, 64, 125; whose Root is less than 6, being divided by 6, the Remainder of the Division, is the Root itself; and if we go further, 216, the Cube of 6, being divided by 6, leaves no Remainder; but the Divisor 6, is itself the Root. Again, 343, the Cube of 7, being divided by 6, leaves 1; which, added to the Divisor 6, makes 7 the Root, &c.

M. de la Hire, on considering this, has found that all Numbers, raised to any Power whatever, have Divisors, which have the same Effect with Regard thereto, that 6 has with Regard to cubic Numbers.

For the finding of these Divisors, he discovered the following general Rules.

If the Exponent of the Power of a Number be even; *i. e.* if the Number be raised to the 2d, 4th, 6th, Power, &c. it must be divided by 2; the Remainder of the Division, in Case there be any, added to 2, or to a Multiple of 2, gives the Root of this Number, corresponding to its Power, *i. e.* the 2d, 6th, &c. Root.

If the Exponent of the Power be an uneven Number; *i. e.* if the Number be raised to the 3d, 5th, 7th Power, the Double of that Exponent will be the Divisor, which has the Property mentioned.

Thus is it found in 6, Double of 3, the Exponent of the Power of all the Cubes. Thus, also 10 is the Divisor of all Numbers raised to the 5th Power, &c.

Root in *ALGEBRA*, denotes a Quantity which is multiplied by itself; or a Quantity considered as the Basis or Foundation of a higher Power.

Thus if any Number, as 2, be multiplied by itself, the Product 4 is called the Square, or second Power of 2;—and 2 itself, with Regard to that Power, is called the Root; or, particularly, the square Root of 4.

Since as Unity is to the square Root, so is the Root to the Square; the Root is a mean Proportional between Unity and the Square.—Thus, 1:2::0:4.

If a Square Number, as 4, be multiplied by its Root 2, the Product 8 is called the Cube, or third Power of 2; and with Respect to this cubic Number

8, the Number 2 is called *Root*; as particularly the *Cube Root*.

Since as Unity is to the *Root*, so is the *Root* to the Square; and as Unity is to the *Root*, so is the Square to the Cube, the *Root* will be to the Square, as the Square to the Cube, *i. e.* Unity, the *Root*, the Square, and the Cube, are in continual Proportion: Thus, 1:2::4:8. And the *cube Root* is the first of the two mean Proportionals between Unity and the Cube.

To extract the *Root*, out of a given Number, or Power, as 8, is the same Thing as to find a Number, as 2, which being multiplied by itself a certain Number of Times, *v. gr.* twice, produces the given Number, 8.

A *Root*, whether square or cubick, or of any higher Power; if it consists of two Parts, is called a *binomial Root*, or simply a *Binomial*; as 24, or 20 + 4. If it consists of three, a *Trinomial*; as 245, 240 + 5. Or 100 + 140 + 5. If of more than three, it is called *Multinomial*; as 2456, or 2450 + 6, or 2400 + 56, or 2000 + 456, or 2000 + 400 + 50 + 6.

Root of an Equation, denotes the Value of the unknown Quantity in an Equation.

Thus if the Equation be $a^2 + b^2 = x^2$, the *Root* of the Equation is the square *Root* of a , and that of b ; expressed thus $\sqrt{a^2 + b^2}$.

Real Root — If the Value of x be positive, *i. e.* if x be a positive Quantity; *e. gr.* $x = r$, the *Root* is called a *real* or *true Root*.

False Root, If the Value of x be Negative, *e. gr.* $x = -5$, the *Root* is said to be false.

POSITIVE Quantity, in *Algebra*, is a real, or affirmative Quantity; or a Quantity greater than nothing; — thus called, in Opposition to a privative or negative Quantity, which is less than nothing.

Positive Quantities, are designed by the Character + prefixed to them, or supposed to be prefixed.

NEGATIVE Quantities, in *Algebra*, those affected with the Sign — and which are supposed to be less than nothing.

REDUCTION of Equations, in *Algebra*, is the clearing them from all superfluous Quantities, bringing down the Quantities to their lowest Terms, and separating the known Quantities from the unknown; till, at length, only the unknown Quantity is found on one Side, and known ones on the other.

The *Reduction* of an Equation is the last Part of the Resolution of the Problem.

The End of all algebraical Operations, is to have the unknown Letter alone in one Member of the Equation; and in the other all the known Letters, without any Mixture of the unknown; for in this Case, it is evident the Value of the unknown Quantity is found.

This Reduction is effected by adding the Quantities subtracted; subtracting those added; multiplying those divided, and dividing those multiplied; extracting the *Root* out of Powers, and raising *Roots* to Powers, so as still to preserve an Equality, this suffices for the *Reduction* of simple Equations; but for higher Equations, the Process is less obvious.

From the Manner wherein Powers are formed, it is evident, that as the unknown Letter is raised to a higher Power, it will be found, in its lower Powers, mixed and combined so many more Times with known Quantities, and of Consequence will be so much the more difficult to be disengaged therefrom. And the Difficulty is the same, where there are several unknown Letters multiplied singly one into another, and again multiplied by known Letters.

The *Reduction* of the Equation being made; from the last Quantity thus gained, the geometrical Construction is to be deduced.

The Method of performing the several Operations in *Algebra*, is by Addition, Subtraction, Multiplication, Division, &c.

ADDITION in Algebra, is performed by connecting the Quantities to be added by their proper Signs;

and also by uniting into one Sum, those that can be so united.

Thus, a and b make $a + b$; a and $-b$ make $a - b$; $-a$ and $-b$ make $-a - b$; ya and ga make $ya + ga$; $-a\sqrt{ac}$ and $b\sqrt{ac}$ make $-a\sqrt{ac} + b\sqrt{ac}$, or $b\sqrt{ac} - a\sqrt{ac}$; for it is all one in whatever Order they be written.

Addition of single whole Quantities (when the Quantities are alike, and have the like Signs) is performed by adding the prefixed Numbers, and adjoining the Quantities with the same Sign.

$$\begin{array}{r|l|l|l|l} \text{Thus} & 1 & a & -3b & +5bc & -6abc \\ 1+2 & 2 & a & -5b & +4bc & 7abc \\ \hline & 3 & 2a & -8b & 9bc & 13abc \end{array}$$

When the Quantities are alike, but have unlike Signs, then the Quotient is subtracted from each other, and the Quantities adjoined with the Signs of the greater.

$$\begin{array}{r|l|l|l|l} \text{Thus} & 1 & 3a & -5b & -9bd & 10abcd \\ 1+2 & 2 & -a & +7b & +7bd & -12abcd \\ \hline & 3 & 2a & +2b & +2bd & -2abcd \end{array}$$

But when the Quantities are unlike (be the Signs so or not) the Quantities must be set down with their respective Quotients, without altering their Signs, and thence arise compound Quantities.

$$\begin{array}{r|l|l|l} \text{Thus} & 1 & a & a & -7bcd \\ 1+2 & 2 & b & -b & +5bdg \\ \hline & 3 & a+b & a-b & 5bdg - 7bcd \end{array}$$

Addition of compound Quantities is performed in the same Manner, and by the same Rules as single Quantities are.

$$\begin{array}{r|l|l|l} \text{Thus} & 1 & a+e & a+e & +3a-b+3c \\ 1+2 & 2 & a+e & a+e & -3a+b-2c \\ \hline & 3 & 2a+2e & 2a & c \text{ } 3e \text{ } 3c \end{array}$$

SUBTRACTION in Algebra is performed by connecting the Quantities with all the Signs of the Subtrahend changed; and at the same Time uniting such as may be united, as is done in *Addition*.

Thus $+7a$ subtracted from $+9a$ makes $+9a - 7a$, or $2a$ in the *Subtraction* of compound algebraical Quantities; the Characters of the Subtrahend are to be changed into the contrary ones, *viz.* $+$ into $-$ and $-$ into $+$.

If one will subtract specious Numbers or Quantities from one another, both those affected with the same, and those with contrary Characters, the Method is this. — 1. If the Quantities designed by the same Letters have the same Signs, and the less to be subtracted from the greater; the Subtraction is performed as in common Arithmetick, *e. gr.*

$$\begin{array}{r} 5b + 4d - f = 5b + 4p - \frac{1}{2} \\ 2b + d - f = 2b + 1p - \frac{1}{2} \\ \hline 3b \quad 3d - 0 \quad 3b + 3p \quad 0 \end{array}$$

2. If a greater Quantity be to be subtracted out of a less; the less must be subtracted out of the greater, and to the Remainder must be prefixed the Sign $-$, if the Quantities be affected with the Sign $+$; or the Sign $+$, if they be affected with $-$.

$$\begin{array}{r} 16a + 2b - 9d = 16 \text{ lib.} + 2b - 9d \\ 19a + 3b - 11d \quad 19 \quad + 3 \quad - 11 \\ \hline -3a - 1b + 2 \quad -3 \quad -1 \quad + 2 \end{array}$$

3. If

3. If the Quantities have different Signs; the Subtraction is converted into Addition, and to the Aggregate is prefixed the Sign of the Quantity, whence the Subtraction is to be made, *v. gr.*

$$\begin{array}{r} 8a - 5c + 9d : = 8 \text{ lib. } -5 + 9d \\ 6a - 8c + 7d = 6 \quad -8 - 7 \\ \hline 2a + 3c + 16d = 2 \text{ lib. } +3 + 16 \end{array}$$

4. If the Quantities be expressed in different Letters, they must be connected; only the Character of the Subtrahend must be changed into the contrary ones for Example;

$$\begin{array}{r} a + b - c \quad \quad a + d \\ d - e + f \quad \quad c - c - g \\ \hline a + b - c - d + e - f \quad a + d - c + e + g \end{array}$$

MULTIPLICATION in *Algebra* is either of single whole Quantities, or of compound Quantities; the Multiplication of single whole Quantities, is performed by joining the Quantities together, whether they be like, or unlike, and to the Product prefixing the Sign +.

Thus 1 + 2	1	a	ab	-bc	-ab
	2	b	cd	-df	-d
	3	ab	abcd	6bcd	abdf

If there be Coefficients, multiply them, and to their Product join the Quantities, set together as before.

Thus 1 + 2	1	5a	7bc	-24bc
	2	b	4ad	-6df
	3	5ab	28adb	+144bcdf

And when the Quantities have unlike Signs, the Operations are the same with the foregoing, only to the Product is prefixed the Sign -.

From hence it appears, that like Signs produce the Affirmative Sign +, but unlike produce the negative Sign -. The Reason thereof may be thus stated: Suppose $a =$ any affirmative Quantity, and let $-b = -2$, than is b equal to 2 less than nothing; (for so are all negative Quantities). Now to multiply any Number or Quantity, implies a putting together of the same, so often as is the Number in the Multiplier, as $a \times 2 = 2a$, or a twice put together; but if the Multiplier be -2 , then it implies the taking away of the a twice; and therefore the Product must needs be $-2a$, that is $a \times -2 = -2a$, or $a \times -b = -ab$, as above. But to multiply $-a$, into -2 by the same Reason, it will take away the Defect of a twice, which is the same as to supply it: Therefore $-a \times -2 = +2a$, or $-a \times -b = ab$.

MULTIPLICATION of compound Quantities is the same with that of single Quantities; for the Product of each Member of the Multiplier, into all the Members of the Multiplicand, (Respect had to the Signs) is the Product.

Thus 1 + 2	1	3a + 5d	2b + c - 4d + f
	2	b	2bc
	3	3ab + 5db	4bbc + 2bcc - 8cbd + 2bcf

DIVISION in *Algebra*, is performed by reducing the Dividend, and the Divisor into the Form of a Fraction, this Fraction being the Quotient.

Thus, if ab were to be divided by cd , it must be placed thus $\frac{ab}{cd}$, and that Fraction is the Quotient.

To perform the Division algebraically, these Rules are to be observed: 1. when the Dividend is equal to the Divisor, the Quotient is Unity, and must be

placed in the Quotient, because every Thing contains itself once.

2. When the Quotient is expressed Fraction-wise, (as in simple Division) if the same Letters are found equally repeated in each Member of the Numerator, and Denominator; cast away those Letters, and the Remainder is the Quotient: Thus, $\frac{ab}{b}$ (a and $\frac{abc}{ac}$ (c , &c.

3. When there are any Co-efficients, divide them as in common Arithmetick, and to the Quotients annex the Quantities expressed by Letters: Thus, $\frac{360ab}{2y6} (=15a$.

4. The general way of Division of compound Quantities, is like the ordinary way in common Arithmetick, Respect being had to the Rules of Algebraical Addition, Subtraction, and Multiplication, as also, that like Signs give +, and unlike - in the Quotient; taking Care to divide every Part of the Dividend by its corresponding Divisor, (that is, that whose Letters shews it of the same Kind with the other) to prevent a Fraction, which otherwise would arise: Thus $a + b) aa + ab - ca - cb (a - c$

$$\begin{array}{r} aa + ab \\ 0 \end{array}$$

$$\begin{array}{r} a - ca - cb \\ -ca - cb \\ 0 \end{array}$$

The Algebraical Operations, are also performed by Involution, Evolution, Fraction, Equation, &c.

INVOLUTION is performed as Multiplication is, (and indeed is no more but Multiplication; differing only in this, that Multiplication may be performed by different Multipliers, but Involution still retains the same) if any Quantity, or Quantities be involved, or drawn into itself, and afterwards into that Product, or again the third Time into the last Product, &c. as manifold as is the Power, so great must be the Number that is used to express it; and this Number is called the Index of the Power, and is set after the Sign in the Margin.

Thus 1 @ 2 1 @ 3 1 @ 4 1 @ 5	1	a	-2a	bc
	2	aa	+4aa	bbcc
	3	aaa	-8aaa	bbbccc
	4	aaaa	+16aaaa	bbbbcccc
	5	aaaaa	-32aaaaa	bbbbbbccccc

This Involution is only of single Quantities; but the Involution of compound whole Quantities, is performed in all respects like Multiplication.

EVOLUTION of single whole Quantities, is done by dividing the Index of the Power of the Quantity (if that Quantity has a Root) by 2, if the square Root be desired, or by 3, if the cube Root, &c. and the Quotient will give the Root required, dealing with the Co-efficients, or prefixed Numbers, as in vulgar Arithmetick.

But if either out of the Indices, or out of the Co-efficients, no exact Root can be extracted according to the Root required; then prefix before it the Sign of the required Root; and thence will arise a sure Quantity.

EVOLUTION of compound Quantities, is the Converse of Involution, and consequently performed by contrary Operations, in the following Manner.

Take so many distinct Quantities, as there are concerned in the Power given to be evolved, and involve those Quantities, so taken, to the Height of the given Power, without respect to the Signs; this new raised Power being compared with the given Power, will shew whether it has a Root or not; which if it have, then it is easily evolved: If not, then it is a sure Compound, and must have its Sign prefixed to it, and is no otherwise to be expressed, till it come to be evolved in Numbers.

As the Process in *Fractions* in algebraick Quantities is almost the same as in *Numbers*, it is not improper to give here (for the Instruction of a Pupil) a clear Demonstration of both.

FRACTION, is a Number which stands to an Unit in the Relation of a Part to its whole.

Fractions are usually divided into Decimal, Sexagesimal, and Vulgar.

DECIMAL *Fractions* are those, whose Denominator is 1, with one or more Cyphers, as 10, 100, 1000, 10,000, &c. Thus $\frac{1}{10}$, $\frac{1}{100}$, $\frac{1}{1000}$, $\frac{1}{10000}$, &c. are decimal Fractions.

The Denominator of a *Fraction* is the Number, or Letter below the Line; shewing into how many Parts, the Integer is supposed to be divided by the *Fractions*. Thus in the *Fraction* $\frac{7}{12}$, seven twelfths, the Number 12 is the Denominator; and shew that the Integer is here divided into 12 Parts.

The Denominator always represents an Integer: In the writing of decimal *Fractions*, we usually omit the Denominator, as only consisting of Unities with Cyphers annexed, and in lieu thereof a Point, or Comma, is prefixed to the Numerator. Thus $\frac{5}{10}$ is wrote 5; $\frac{46}{100}$, 46, &c.

The Numerator is that Part of the *Fraction*, which is placed over the little Bar, by which it is separated from the under Number, called the Denominator, which shews into how many Parts the Integer is divided. Thus, *v. gr.* $\frac{7}{10}$ expresses seven Tenths, where seven is the Numerator, and ten the Denominator.

As Cyphers on the Right-hand of Integers do increase their Value decimally, as 2, 20, 200, &c. so when set on the Left-hand of decimal *Fractions*, they decrease the Value decimally, as 5, 05, 005, &c. when set on the Left-hand of Integers, or the Right-hand of Decimals, they signify nothing but only to fill up Places; Thus, 5000, or 0005, is but five Units.

SEXAGESIMAL *Fractions*, are Fractions whose Denominator proceeds in a sexagecuple Ratio.

In these Fractions, which some also call astronomical Fractions, the Denominator, being always 60, or a Multiple thereof, is usually omitted, and the Numerator only written down; thus, $4^{\circ} 59' 32'' 50'''$, 16''', is to be read, 4 Degrees, 59 Minutes, 32 seconds of a Degree, or both Parts of a Minute, 50 Thirds, 16 Fourths, &c.

VULGAR *Fractions*, called also simple *Fractions*, are always expressed by two Numbers, the one wrote over the other, with a Line between them.

The Denominator of the Fraction, denotes the Unit, or whole, that is divided into two Parts; and the Numerator of the Fraction expresses the Parts given in the present Case. Thus two third Parts of a Line, or other Things are wrote $\frac{2}{3}$, where the Denominator 3, shews, that the whole Line is supposed to be divided into three equal Parts; and the Numerator 2, indicates, or assigns two of such Parts.

The real Design of adding the Denominator is to shew what aliquot Part the broken Number has in common with Unity.

To reduce *Fractions* in Algebra to their least Terms, the Numerators and Denominators are to be divided by the greatest common Divisor, as in Numbers.

Thus Fraction $\frac{a^2 c}{b^2 c}$ is reduced to a more simple one $\frac{a^2}{b^2}$ by dividing both $a^2 c$ and $b^2 c$ by c : and $\frac{203}{667}$ is reduced to a more simple one $\frac{7}{23}$ by dividing both 203 and 667 by 29: and $\frac{203 a a c}{667 b c}$ is reduced to $\frac{7 a a}{23 b}$ by dividing by $29 c$. and so $\frac{b a^3 - 2 a c c}{b a a + 3 a c}$ becomes $\frac{2 a a - 3 c c}{2 a + c}$ by dividing by $3 a$. and $\frac{a^3 - a a b + a b b - 63}{a a - a b}$ becomes $\frac{a a + b b}{a}$ by dividing by $a - b$.

To reduce Fractions to a common Denominator, the Term of each are to be multiplied, by the Denominator of the other.

Thus having $\frac{a}{b}$ and $\frac{c}{d}$ multiply the Term of one $\frac{a}{b}$ by d , and also the Term of the other $\frac{c}{d}$ by b , and they will become $\frac{a d}{b d}$ and $\frac{b c}{b d}$ whereof the common Denominator is $b d$, and thus a and $\frac{a b}{c}$ or $\frac{a}{1}$ and $\frac{a b}{c}$ becomes $\frac{a c}{c}$ and $\frac{a b}{c}$.

But where the Denominators have a common Divisor, it is sufficient to multiply them alternately by the Quotients.

Thus the *Fraction* $\frac{a^3}{b^3 c}$ and $\frac{a^3}{b^3 d}$ are reduced to these $\frac{a^3 d}{b^3 c d}$ and $\frac{a^3 c}{b^3 c d}$ by multiplying alternately by the Quotients c and d , arising by the Division of the Denominators by the common Divisor b .

The Process of Addition, and Subtraction of Fraction in Species, is, in all Respects, the same as in Numbers. *E. gr.* suppose it be required to add the *Fractions* $\frac{a}{b}$ and $\frac{c}{d}$ these when reduced to the same Denomination, will be $\frac{a d}{b d}$ and $\frac{b c}{b d}$ consequently their Sum is $\frac{a d + b c}{b d}$.

So, if the *Fraction* $\frac{a}{b}$ were to be subtracted from $\frac{c}{d}$: having reduced them they will be $\frac{a d}{b d}$ and $\frac{b c}{b d}$ as before: Their Difference therefore, is $\frac{b c - a d}{b d}$.

The Multiplication and Division of *Fractions*, are also perfectly the same here as in vulgar Arithmetick. — Thus *e. gr.* Suppose the Factors, or Fractions, to be multiplied, $\frac{a}{b}$ and $\frac{c}{d}$ the Product will be $\frac{a c}{b d}$.

Or suppose the *Fractions* required to be divided, $\frac{a c}{b d}$ and $\frac{a}{b}$: the Quotient will be $\frac{a c}{b d} \div \frac{a}{b} = \frac{a b c}{a b d} = \frac{c}{d}$ hence as $a = \frac{a}{1}$: the Product of a into $\frac{c}{d}$ that is of an integral Quantity into a *Fraction*, $\frac{c}{d} \frac{a}{1} = \frac{a c}{d}$ whence it appears that the Numerator of the Fraction is to be multiplied by the Integer.

Hence also the Quotient of $\frac{c}{d}$ by a , that is of the broken Quantity, divided by the whole one, $\frac{c}{d} \div a = \frac{c}{a d}$.

Besides the common Notion of a *Fraction*, there is another necessary to be understood thus.

Suppose $\frac{1}{4}$ of 20 s. or a Pound Sterling, were the Fraction; this Fraction instead of three Quarters of one Pound, may be considered as a fourth Part of three Pounds; that is by taking as many of the Integers, as the Numerator expresses, (*viz.* 3.) and dividing them by 4, the Denominator; for then the Quotient of the same Value, will arise for 4) 60 s. 15 s. this shews the Reason of the Manner of Expression used by Geometers, and Algebraists, who read $\frac{a}{b}$, thus, as divided by b .

SURD, denotes a Number that cannot be expressed, or a Number that is incommensurate to Unity.

When any Number, or Quantity, hath its Root proposed to be extracted, and yet is not a true figurate Number of that Kind; that is, if its square Root be demanded, and it is not a true Square: If its cube Root be required, and itself be not a true Cube, &c. then it is impossible to assign, either in whole Numbers, or Fractions, any exact Root of such Number proposed. And when even this happens, it is usual in *Mathematicks* to mark the required Root of such Numbers or Quantities by prefixing before it the proper Mark of Radicality which is $\sqrt{}$: thus $\sqrt{2}$ signifies the square Root of 2, and $\sqrt[3]{16}$ signifies the cubic Root of 16: which Roots, because they are impossible to

be expressed in Numbers exactly, are properly called *furd Roots*.

Roots can also be expressed by their Indexes without the radical Sign; thus x^2 , x^3 , x^4 , signify the square Cube, and fifth Power of x ; so $x^{\frac{1}{2}}$, $x^{\frac{1}{3}}$, $x^{\frac{1}{4}}$, signify the square Root, Cube, &c. of x .

EQUATION, or **ÆQUATION**, in *Algebra*, an Expression of the same Quantity, in two different, that is, dissimilar, but equal Terms or Denominations.

As when we say, $2 \cdot 3 = 4 + 2$; that is, twice three is equal to four and two.

Stifelius defines *Equation* to be the Ratio of Equality between two Quantities differently denominated: As when we say 3 Shill. = 36 Pence. Or 50 Shill. = 2 l. 10 Shill. = 600 Pence = 2400 Farth. Or $b = d + c$. Or $12 = a - P$, &c.

Hence the Reduction of two heterogeneous or dissimilar Quantities to the same Value, *i. e.* to an Equality, is called the *bringing them to an Equation*.

The Character, or Sign of an *Equation*, is $=$ or x .

The resolving of Problems, by Means of *Equations*, is the Business of *Algebra*.

Terms of an EQUATION, are the several Quantities, or Parts, of which an *Equation* is composed, connected together by the Signs $+$ and $-$ thus in the Equation $b + c = d$; the Terms are b , c and d . And the Tenor or Import of the *Equation* is, that some Quantity represented by d , is equal to two others represented by b and c .

Root of an EQUATION, is the Value of the unknown Quantity in the *Equation*. *E. gr.* If $a^2 + b^2 = x^2$; the Root will be $\sqrt{a^2 + b^2}$.

Equations are divided, with regard to the Powers of the unknown Quantities, into *Simple*, *Quadratick*, *Cubick*, &c.

Simple EQUATION, is that wherein the unknown Quantity is only of one Dimension, or in the first Power. As, $x = (a + b) : 2$.

Quadratick EQUATION, is that wherein the unknown Quantity is of two Dimensions, or in the second Power: As $x^2 = a^2 + b^2$.

Cubick EQUATION, is that wherein the unknown Quantity is of three Dimensions: As $x^3 = a^3 - b^3$, &c.

If the unknown Quantity be of four Dimensions, as $x^4 = a^4 - b^4$, the Equation is called a *Biquadratick*; if of 5, a *Surdesolid*.

Equations are considered two Ways; either as ultimate Conclusions, we arrive at in the Solution of Problems; or as Means, by the Help whereof we arrive at those final Solutions.

An *Equation* of the first Kind, consists only of one unknown Quantity, intermixed with other known Quantities. Those of the latter Kind, consist of several unknown Quantities, which are to be compared, and connected together, till out of them all arises a new *Equation*, wherein the unknown Quantity sought, is mixed with the known. To get the Value of which unknown Quantity, the *Equation* is generally turned, and transformed various Ways, till it be brought as low, and rendered as simple as possible.

The Doctrine and Practice of *Equations*, that is, the Solution of Questions by *Equations*, consists of several Steps or Parts, *viz.* 1. The Denominating of the several Quantities, or expressing them in proper Signs or Symbols. 2. The bringing the Quantities thus denoted, to an *Equation*. 3. The reducing that *Equation* to its lowest and simplest Terms. To which 4. may be added, the Construction of the *Equation*, or representing it in geometrical Lines.

With Regard to the first; a Question or Problem being proposed, we conceive the Thing sought or required, as already done; and accordingly note or express it by one of the Vowels, as *a*, or more usually by one of the last Letters of the Alphabet, *x*, *y*, or *z*; noting the other known Quantities by the Consonants,

or the beginning Letters of the Alphabet, *b*, *c*, *d*, &c.

The Question being thus stated in Species, it is considered whether or no it be subject to any Restrictions, *i. e.* whether it be determinate or no; which is found by these Rules.

1. If the Quantities sought or required, be more than the Number of Equations given, or contained in the Question, it is indeterminate, and capable of innumerable Solutions. The *Equations* are found, if they be not expressly contained in the Problem itself, by the Theorems of the Equality and Quantities.

2. If the Equations given or contained in the Problem, be just equal in Number with the unknown Quantities, the Question is determinate, or has one only Solution.

3. If the unknown Quantities be fewer than the given Equations, the Question is yet more limited, and sometimes discovers itself impossible, by some Contradiction between the *Equations*.

Now, to bring a Question to an EQUATION, that is, to bring the several mediate *Equations*, to one final one; the principal Thing to be attended to, is to express all the Conditions thereof, by so many *Equations*. In order to which it is to be considered, whether the Proportions or Sentences, wherein it is expressed, be all of them fit to be noted in Algebraick Terms; as our Conceptions used to be in *Latin* or *Greek* Characters: And if so, as is generally the Case in Questions about Numbers, or abstract Quantities; then let Names be given both to the known and unknown Quantities, as far as Occasion requires; and thus the Drift of the Question will be couched, as we may call it, in the *Algebraick Language*; and the Conditions thus translated to algebraick Terms, will give as many *Equations* as are necessary to solve it.—To illustrate this by an Instance: Suppose it required to find three Numbers, in continual Proportion, whose Sum is 20, and the Sum of their Square 140; putting *x*, *y*, *z*, for the Names of the three Numbers sought, the Question will be translated out of the verbal to the symbolical Expression, thus:

The Question in Words.

In Symbols

Required three Numbers on these Conditions,	$x, y, z,$
That they be continually proportional.	
al.	$x : y :: y : z, \text{ or } xz = yy.$
That the Sum be 20,	$x + y + z = 20.$
And the Sum of their Squares 140.	$xx + yy + zz = 140.$

Thus is the Question brought to these *Equations*, *viz.* $xz = yy$. $x + z + y = 20$ and $xx + yy + zz = 140$ by the Help whereof *x*, *y*, and *z*, are to be found.

The Solution of Questions are, for the most Part, so much the more Expedite and Artificial, by how much the unknown Quantities, you have at first, are the Fewer; thus, in the Question proposed, putting *x* for the first Number, and *y* for the Second $\frac{yy}{x}$ will be the third Proportional; which being put for the third Number, bring the Question into *Equations* as follows.

The Question in Words.

Symbolically.

There are sought three Numbers in continual Proportion,	$x, y, \frac{yy}{x}$
Whose Sum is 20.	
And the Sum of their Squares 140.	$xx + yy + \frac{yy^2}{x} = 140.$

You have therefore the Equations $x + y + \frac{yy}{x} = 20$

K

and

and $x^2 + y^2 + \frac{y^4}{x^2} = 140$ by the Reduction whereof, x and y are to be determined.

Take another Example: A Merchant increases his Estate annually by a third Part, abating 100*l.* which he spends yearly in his Family; and after three Years he finds his Estate doubled. *Query*, What is he worth? To resolve this it must be observed, that there are (or lie hid) several Proportions which are all thus found out and laid down.

In English.	Algebraically.
A Merchant has an Estate,	x
Out of which the first Year he expends 100 <i>l.</i>	$x - 100$
And augments the rest by one Third,	$x - 100 + \frac{x - 100}{3}$ or $\frac{4x - 400}{3}$
And the second Year he expends 100 <i>l.</i>	$\frac{4x - 400}{3} - 100$, or $\frac{4x - 700}{3}$
And augments the rest by one Third,	$\frac{4x - 700}{3} + \frac{4x - 700}{9}$ or $\frac{16x - 2800}{9}$
And so the third Year he expends 100 <i>l.</i>	$\frac{16x - 2800}{9} - 100$ or $\frac{16x - 3700}{9}$
And by the rest gains likewise one Third,	$\frac{16x - 3700}{9} + \frac{16x - 3700}{27}$ or $\frac{64x - 14800}{27}$
And he becomes at length twice as rich as at first.	$\frac{64x - 14800}{27} = 2x$.

Therefore the Question is brought into this Equation $\frac{64x - 14800}{27} = 2x$ by the Reduction whereof you will find $x = 14800$, viz. Multiply it into 27 and you have $64x - 14800 = 54x$; subtract $54x$, and there remains $10x - 14800 = 0$, or $10x = 14800$ and dividing by 10 you have $x = 1480$ so that the Value of his Estate at first was 1430*l.*

It appears then, that to the Solution of Question about Numbers, or the Relations of abstract Quantities, there is scarce any Thing more required, but to translate them out of the common, into algebraick Language, *i. e.* into Characters proper to express our Ideas of the Relations of Quantities. Indeed, it may sometimes happen, that the Language wherein the Question is stated, may seem unfit to be rendered into the Algebraical; though by making a few Alterations therein, and attending to the Sense, rather than the Sound of the Words, the Translation becomes easy enough. The Difficulty here, results merely from the Difference of Idioms, which is as observable between most Languages, as between the Common and Symbolical.

Algebra has been also applied to the Consideration and Calculus of Infinites; from whence a new and extensive Branch of Knowledge has arose, called the *Doftrine of Fluxions*, or *Analysis of Infinites*, or the *Calculus Differentialis*.

FLUXION, in the *Newtonian Analysis*, denotes the Velocity with which a flowing Quantity is increased by its generative Motion.——By which it stands contradistinguished from the *Fluxient*, or the *flowing* Quantity, which is gradually and indefinitely increasing; after the Manner of a Space, which a Body in Motion describes.

Method of FLUXIONS, is the Arithmetick and Analysis of *Fluxions*, and *Fluents*, or flowing Quantities.

Foreigners usually define the Method of *Fluxions*, the Arithmetick, or Analysis, of infinitely, or rather indefinitely, small variable Quantities; or the Method of finding an infinite small, or an infinitely small Quantity, which being taken an infinite Number of Times, becomes equal to a given Quantity.

Sir *Isaac Newton*, and after him the *English* Authors, call these infinitely small Quantities, *Moments*; as considering them the momentary Increments and Decrements of variable Quantities, *e. gr.* of a Line, considered as generated by the Flux of a Point; of a Surface generated by the Flux of a Line.

Accordingly, the variable Quantities are called *Fluent*, or flowing Quantities; and the Method of

finding either the *Fluxion* or the *Fluent*, the Method of Fluxions.

M. Leibnitz considers the same infinitely small Quantities, as the Differences or Differentials of two Quantities; and calls the Method of finding those Differences, the *Differential calculus*.

Each of these Ways of considering and denominating, has its Advantage, which the Retainers to this or that Method, strenuously assert.

Flowing Quantities, *i. e.* such as in the Genesis of Figures by local Motion, are continually increasing and diminishing, are certainly very properly denominated *Fluents*: And as all Figures may be conceived as so generated; the infinitely small Increments or Decrements of such Quantities are very naturally denominated *Fluxions*.

Beside this Difference in the Name, there is another in the Notation.

Sir *Isaac Newton* expresses the *Fluxion* of a Quantity, as \dot{x} , by \dot{a} .

Dot placed over it, as \dot{x} ; and Mr. *Leibnitz* expresses his Differential of the same x , by prefixing a d , as dx ; each of which Methods of Notation has likewise its Advantage.

Setting aside these Circumstances, the two Methods are the same.

The Method of Fluxions is one of the greatest, most subtil and sublime Discoveries of this, or perhaps any other Age; it opens a new World to us, and extends our Knowledge, as it were to Infinity. It carries us beyond the Bounds that seemed to be described to the human Mind, at least infinitely beyond those to which antient Geometry was confined.

The History of this important Discovery, as fresh as it is, is a little dark and embroiled. Two of the greatest Men of this Age, do both of them claim the Invention, Sir *I. Newton*, and *Leibnitz*; and nothing can be more glorious for the Method itself, than the Zeal wherewith the Partizans of either Side have asserted their Title.

To give the Reader a just View of this noble Dispute, and of the Pretensions of each Party, we shall lay before him the Origins of the Discovery, and mark where each Claim commenced, and how it was supported.

The first Time the Method made its Appearance in Publick, was in 1684; when *M. Leibnitz* gave the Rules thereof in the *Leipsc Acts* of that Year; but the Demonstrations he kept to himself. The two Brothers the *Benoulli's*, were presently struck with it; and found out the Demonstrations, though very difficult; and practised the *Calculus* with surprizing Success.

This is all we hear of it, till the Year 1687; when Sir *I. Newton's* admirable *Principia* came forth, which is almost wholly founded on the same *Calculus*.

The common Opinion at that Time was, that Sir *Isaac*, and *M. Leibnitz* each had invented it about the same Time: And what confirmed it was, that neither of them made any Mention of the other; and that, though they agreed in the Substance of the Thing, yet they differed in their Way of conceiving; called it by different Names, and used different Characters.

In effect, *M. Leibnitz's* Character, was supposed by Foreigners to be somewhat more commodious than that of Sir *Isaac Newton*; accordingly the Method soon spreading itself throughout *Europe*, *M. Leibnitz's* Character went with it; by which Means the Geometricians were insensibly accustomed to look on him as the sole and principal Inventor.

The two great Authors themselves, without any seeming Concern, or Dispute, as to the Property of the Invention, enjoyed the glorious Prospect of the Progresses continually making under their Auspices, till the Year 1699; when the Peace began to be disturbed.

M. Fatio, in a Treatise of the Line of swiftest Descent, having declared that he was obliged to own Sir *I. Newton* as the first Inventor of the *Differential calculus*,

calculus, and the first by many Years; and that he left the World to judge, whether Mr. *Leibnitz*, the second Inventor, had taken any Thing from him: This precise Distinction between first and second Inventor, with the Suspicion it insinuated, raised a Controversy between *M. Leibnitz*, supported by the Editors of the *Leipsic Acts*, and the *English* Geometricians, who declared for Sir *Isaac Newton*.

Sir *Isaac* himself never appeared on the Scene; his Glory was become that of the Nation, and his Adherents, warm in the Cause of their Country, needed him not to animate them.

Writings succeeded each other, but slowly on either Side; probably on Account of the distant Places; but the Controversy grew still hotter and hotter; till at length it came to such pass, that in the Year 1711, *M. Leibnitz* complained to the Royal Society, that Dr. *Keil* had accused him of publishing the Method of *Fluxions* invented by Sir *Isaac Newton*, under other Names and Characters.

He insisted that no Body knew better than Sir *Isaac* himself, that he had stolen nothing from him; and required that Dr. *Keil* should publicly disavow the ill Construction which might be put on his Words.

The Society, here appealed to as Judge, appointed a Committee to examine all the old Letters, Papers, &c. that had passed among the several Mathematicians, relating to the Point; and after a strict Examen of all the Evidences that could be produced, gave in their Report, "That it did not appear that *M. Leibnitz* knew any thing of the *Differential Calculus* before a Letter wrote him by Sir *Isaac Newton*, and sent to him at *Paris*, in the Year 1672; wherein the Method of *Fluxions* was sufficiently explained, to let a Man of his Sagacity into the whole Matter; and that Sir *Isaac Newton* had even invented his Method before the Year 1669, and of Consequence fifteen Years before *M. Leibnitz* had given any thing on the Subject in the *Leipsic Acts*," and thence they concluded, that Dr. *Keil* had not at all injured *M. Leibnitz* in what he had said.

The Society printed this Censure of theirs, together with all the Pieces and Materials relating thereto, under the Title of *Commercium epistolicum de analysi promota*, London 1712. This Book was carefully distributed through *Europe*, to vindicate the Title of the *English* Nation to the Discovery; for Sir *Isaac*, as already hinted, never appeared in it; whether it were that he trusted his Honour with his Compatriots, who were zealous enough in the Cause; or whether it were that he was even superior to the Glory thereof.

M. Leibnitz and his Friends could not shew the same Indifference: He was accused of a Theft; and the whole *Commercium epistolicum*, either expresses it in Terms, or insinuates it.—Soon after the Publication thereof, a loose Sheet was publish'd at *Paris*, in Behalf of *M. Leibnitz*, then at *Vienna*; it is wrote with a World of Zeal and Spirit, and maintains boldly, that the Method of *Fluxions* has not preceeded that of *Differences*; and even insinuates, that it might have arisen from it.

The Detail of the Proofs on each Side would be too long, and could not be understood without a large Comment, which must enter into the deepest Geometry.

M. Leibnitz had begun to work upon a *Commercium epistolicum*, in Opposition to that of the Royal Society; but he died before it was completed.

It must be own'd there are strong Presumptions in Favour of *M. Leibnitz*; Presumptions, we mean, that he was no Plagiary: For that Sir *Isaac Newton* was the first Inventor, is past all Dispute; his Glory is secure, the reasonable Part, even, among the Foreigners, allow it; and the Question is only whether *M. Leibnitz* took it from him, or fell upon the same Thing with him: For in his *Theory of abstract Motions*, which he dedicated to the Royal Academy, in 1671. before he had seen any Thing of Sir *Isaac Newton's*, he already supposed infinitely small Quan-

ties, some greater than others, which is one of the great Principles of the System.

The Doctrine consists of two Parts, viz. the direct Method of *Fluxions*, called also *calculus differentialis*; and the inverse Method of *Fluxions*, or *calculus integralis*.

The latter is directly opposite to the former; and is a Sequel of it. Both of them are adopted into a new Geometry, and make reigning Methods therein.

The First descends from finite to infinite; the latter ascends from infinitely small, to finite; the one de-compounds a Magnitude, the other re-establishes it.

The Foundation of the direct Method of *Fluxions* amounts to this Problem: The Length of the Space described being continually, (that is, at all Times given) to find the Velocity at any Time propos'd.

The Foundation of the inverse Method of *Fluxions* amounts to this Problem: The Velocity of the Motion being continually given to find the Space described by it any Time proposed.

Direct Method of Fluxions.—All finite Magnitudes are here conceived to be resolved into infinitely small ones; which are the Elements, Moments, or Differences thereof. The Art of finding these infinitely small Quantities, and of the Working on them, and discovering other infinite Quantities by their Means, makes the direct Method of *Fluxions*.

What renders the Knowledge of infinitely small Quantities of such infinite Use and Extent, is that they have Relations to each others, which the finite Magnitudes, whereof they are the Infinite-smalls, have not.

Thus, *e. gr.* in the Curve of any Kind whatever, the infinitely small Differences of the Ordinate and Abscisse, but of the Ordinate and Subtangent; and of Consequence, the Abscisse and Ordinate alone being known, give the Subtangent unknown; or, which amounts to the same, the Tangent itself.

The Method of Notation in *Fluxions*, introduced by the Inventor Sir *Isaac Newton*, is thus:

The variable or flowing Quantity, to be uniformly augmented, as suppose the Abscisse of a Curve, he denotes by \dot{x} , or \dot{U} ; and the other flowing Quantities he denotes by the Letters v, x, y, z ; and their *Fluxions* by the same Letters, with Dots placed over them, thus $\dot{v}, \dot{x}, \dot{y}, \dot{z}$.

Again, as the *Fluxions* themselves are also variable Quantities, and are continually increasing or decreasing; he considers the Velocities with which they increase or decrease, as the *Fluxions* of the former *Fluxions*, or second *Fluxions*, which are denoted with two Dots over them, thus, $\ddot{x}, \ddot{y}, \ddot{z}$.

After the same Manner one may consider the Augments and Diminutions of these, as their *Fluxions* also; and thus proceed to third, fourth, fifth, &c.

Fluxions, which will be noted thus $\ddot{y}, \ddot{x}, \ddot{z}, \ddot{y}, \ddot{x}, \ddot{z}$ &c.

Lastly, if the flowing Quantity be a Surd, as

$\sqrt{a-b}$; he notes its *Fluxion* $\dot{\sqrt{a-b}}$: If a Fraction $\frac{x}{y}$ he notes it, $\dot{\frac{x}{y}}$. *V. Wallis's Algebra*, p. 392.

The chief Scope and Business of *Fluxions*, is from the flowing Quantity given, to find the *Fluxion*: For this we shall lay down one general Rule, as stated by Dr. *Wallis*; and afterwards apply and exemplify it in the several Cases.

"Multiply each Term of the Equation separately
"by the several Indices of the Powers of all the
"flowing Quantities contained in that Term; and in
"each Multiplication, change one Root or Letter of the Power into its proper *Fluxion*: The Aggregate of all the Products connected together by
"their proper Signs, will be the *Fluxion* of the Equation desired."

The Application of this Rule will be contained in the following Cases.

In the general: To express the *Fluxions* of simple variable Quantities as already mentioned, you need only put the Letter or Letters, which express them, with a Dot over them: Thus the *Fluxion* of x is \dot{x} , and the *Fluxion* of y is \dot{y} , and the *Fluxion* of $x+y$ is $\dot{x}+\dot{y}$, is $\dot{x}+\dot{y}+\dot{v}+\dot{z}$, &c.

Note, for the *Fluxion* of permanent Quantities, when any such are in the Equation, you must imagine 0, or a Cypher; for such Quantities can have no *Fluxion*, properly speaking, because they are without Motion, or invariable.

To find the *FLUXIONS* of the Products of two or more variable or flowing Quantities.—Multiply the *Fluxion* of each simple Quantity by the Factors of the Products, or the Product of all the rest; and connect the last Products by their proper Signs; the Sum or Aggregate is the *Fluxion* sought.

Thus the *Fluxion* of xy , is $\dot{x}y + x\dot{y}$, and the *Fluxion* of xyz , is $\dot{x}yz + x\dot{y}z + xy\dot{z}$; and the *Fluxion* of xyz is $\dot{x}yz + x\dot{y}z + xy\dot{z}$; and the *Fluxion* of $a+xx$ by $b-y$ (the common Product being $ab+bx-ya-xy$) will be $\dot{b}x - \dot{y}a - \dot{x}y - x\dot{y}$.

To find the *FLUXION* of a Fraction, — Multiply the *Fluxion* of the Numerator by the Denominator, and after it place (with the Sign $-$) the *Fluxion* of the Denominator; this will be the Numerator, and the Square of the Denominator will be the Denominator of the Fraction, expressing the *Fluxion* of the given Fraction.

Thus the *Fluxion* of $\frac{x}{y}$ is $\frac{\dot{x}y - x\dot{y}}{yy}$

For suppose $\frac{x}{y} = z$, then will $x = yz$; which equal Quantities will have equal *Fluxions*; therefore $\dot{x} = \dot{y}z + y\dot{z}$, and $\dot{x} - y\dot{z} = \dot{y}z$, &c. and dividing all by $\dot{y}\frac{x-xy}{y} = \dot{z}$ because $\frac{x}{y} = z$ $\frac{y\dot{x} - x\dot{y}}{yy}$ wherefore this last is the *Fluxion* of the Fraction $\frac{x}{y} = z$ because z being $\frac{x}{y}$, z will be equal to the *Fluxion* of $\frac{x}{y}$.

And the *Fluxion* of $\frac{a}{x}$ will be $-\frac{\dot{x}a}{xx}$; for the permanent Quantity a , having no *Fluxion*, there can be no Product of the *Fluxion* of the Numerator into the Denominator, as there would have been had a , been x , z , or any other variable Quantity.

To find the *FLUXION* of a Power, — multiply the Power (first brought one Degree lower) by the Index of that first Power; and the Product by the *Fluxion* of the Root.

Thus the *Fluxion* of xx will be $2xx$; for $xx = xx$; but the *Fluxion* of $xxz = xx + xz = 2xx$, &c. and the *Fluxion* of x^3 will be $3xx$. That of x^4 will be $4x^3$, &c. or if m , expresses the Index of any Power, as suppose x^m , its *Fluxion* will be $m x^{m-1} \dot{x}$, or $m x x^{m-2} \dot{x}$; For x^m brought one Degree lower (m being a general Index) must be x^{m-1} ; then that x by m , the Index, makes $m x^{m-1}$; and this last by the *Fluxion* of the Root produces $m x^{m-1} \dot{x} = 1 \dot{x}$.

If the Power be produced from a Binomial, &c. as suppose $xx + 2xy + yy$, its *Fluxion* will be $2xx + 2xy + 2yy$.

If the Exponent be Negative, as suppose x^{-m} or $\frac{1}{x^m}$, its *Fluxion* will be $-m x^{-m-1} \dot{x}$.

Or if you would do it by way of Fraction, $\frac{m x^{m-1} \dot{x}}{x^m}$ (for the Square of x^m is as well x^{2m} as x^m or according to Sir Isaac Newton's Method, which is yet shorter, $\frac{-x^m}{x^m + \dot{x}}$.

If the Power be imperfect, *i. e.* if its Exponent be a Fraction as suppose $\sqrt[n]{x}$; or in the other Notation $\frac{m}{n}$, suppose $\frac{m}{n} = z$: Then if you raise up each Number to the Power of n , it will stand thus, $x^m = z^n$; the *Fluxion* of which will be, by this general Rule, $m x^{m-1} \dot{x} = n z^{n-1} \dot{z}$ wherefore z will

$$= \frac{m x x^{m-1}}{n z^{n-1}} \text{ (by dividing both Parts by } n z^{n-1} \text{)}$$

$$\text{and } \frac{m x x^{m-1}}{n z^{n-1}} = \frac{m}{n} x^{\frac{m}{n}-1} \dot{x}; \text{ or } \frac{m}{n} \dot{x} \sqrt[n]{x} : x^m - n,$$

putting instead of $n z^{n-1}$, its Value $n x^{\frac{m}{n}-1}$.

Hence, to find the *Fluxion* of any Kind of Power, proceed thus. — Multiply the Power given by its Index or Exponent, and then that Product by the *Fluxion* of the Root of the Power given; and after that subtract 1, or Unity, from the Index of the Power.

To find the *FLUXION* of surd Quantities — suppose if required to find the *Fluxion* of $\sqrt{2rx - xx}$, or $2rx - xx$. Suppose $2rx - xx = z$; then is $2rz - xx = zz$: and consequently $rx - xx = zz$; and, by Division, $\frac{rx - xx}{z} = z$ (by Substitution

$$\frac{rx - xx}{\sqrt{2rx - xx}} = \text{to the } \text{Fluxion of } \sqrt{2rx - xx}.$$

If it be required to find the *Fluxion* of $\sqrt{ay - xx}$ 3; for $ay - xx$ 3 put z ; then $ay - xx = z^3$, and $ay - 2xx = \frac{1}{3} z^3$: and multiplying by 3, $3ay - 6xx = z^3$; and consequently $3az^{\frac{2}{3}} - 6z^{\frac{2}{3}}xx = z^3$ equal (substituting $ay - xx = z^3$) $3a^3y^2y - 6a^2xx = z^3$ $yy + 3ax^4y - 6a^2y^2xx + 12ayx^3x - 6x^5x =$ to the *Fluxion* of $ay - xx$.

To find the *FLUXIONS* of Quantities compounded of rational and surd Quantities — let it be required to find the *Fluxion* of $bxx + cax + ca^2x\sqrt{xx + aa} = z$. Put $bxx + cax + ca^2x = p$, and $\sqrt{xx + aa} = q$. Then the given Quantity is $pq = z$, and the *Fluxion*

thereof is $p\dot{q} + q\dot{p} = \dot{z}$: But \dot{q} is $\frac{\dot{x}x}{\sqrt{xx + aa}}$, and \dot{p} is $2bx + ca$; therefore in the Equation $p\dot{q} + q\dot{p} = \dot{z}$, if in the Place of p, q, \dot{p}, \dot{q} , we restore the Quantities they represent, we shall have $\frac{bx + ca}{\sqrt{xx + aa}} + (2bx + ca)\sqrt{xx + aa} = \dot{z}$ which being reduced to one Denomination, gives $3bx^3 + 2acx^2 + ca^2x + 2ba^2x + ca^3x = \dot{z}$ to the *Fluxion* of $\sqrt{xx + aa}$ the given Quantity.

Inverse Methods of *FLUXIONS*, or *calculus integrabilis*, consists in finding finite Magnitudes, from the infinitely small Parts thereof.

It proceeds, as already observed, from infinitely small Quantities to finite; and recomposes and sums up what the other had resolved; whence it is also called the *Summatory calculus*.

But what that has decomposed, this does not always re-establish; so that the inverse Method is limited, and imperfect, at least hitherto. If it were once compleat, Geometry would be arrived at its last Perfection.

To give an Idea of its Nature and Office, take the Instance already propos'd in the direct Method; in that the infinite small Quantities of the Ordinate and Absciss, being known, give the Subtangent required. In this, on the contrary, the Subtangent of an unknown Curve being had, gives the infinitely small Quantities of the Absciss and Ordinate themselves; which are finite Magnitudes, in whose Relation the whole Essence of the Curve is founded.

But the distinguishing Use of this Method is in measuring the Base of a Parallelogram multiplied by the infinitely small Element of its Altitude, gives an infinitely small Parallelogram which is the Element of the finite Parallelogram, and is repeated an Infinity of Times therein, *i. e.* as many Times as there are Points in the Height of the Parallelogram.

To have the finite Parallelogram, therefore, by Means of its Element, the Element must be multiplied by its Altitude; which is the inverse Method of *Fluxions*; re-ascending from the infinitely small Quantity to the finite.

Such a Circuit of Infinite-smalls, it is true, were impertinent in so simple a Case; but when we have to do with Surfaces terminated by Curves, the Method then

then becomes necessary, or at least superior to any other.

Suppose, *e. gr.* in a Parabola, the Space included between two infinitely near Ordinates, an infinitely small Portion of the Axis, and an infinitely little Arch of the Curve; it is certain, this infinitely small Surface is no Parallelogram, since the two parallel Ordinates which terminate it on one Side, are not equal; and the Arch of the Curve, opposite to the little Portion of the Axis, is frequently neither equal nor parallel thereto. And yet this Surface, which is no Parallelogram, may be considered, in the strictest Geometry, as if it really were one, by reason it is infinitely small, and the Error, of consequence, infinitely little, *i. e.* none.

So that to measure it, there needs nothing but to multiply an Ordinate of the Parabola by the infinitely small Portion of the Axis corresponding thereto. Thus we have the Element of the whole Parabola; which Element being raised by the inverse Method to a finite Magnitude, is the whole Surface of the Parabola.

This Advantage so peculiar to the Geometry of Infinites, of being able without any Error to treat little Arches of Curves, as if they were Right-lines; curvilinear Spaces, as if rectilinear ones, &c. enables it not only to go with more Ease and Readiness than the antient Geometry, to the same Truths; but to reach a great Number of Truths inaccessible to the other.

Its Operations, in Effect, are more easy, and its Discoveries more extensive; and Simplicity and Universality are its distinguishing Characters.

To find the flowing Quantity belonging to any FLUXION given, — To have the Doctrine of the inverse Method correspond and keep Pace with that of the direct, we will apply it in the same Cases.

In the General, to express the variable Quantity of a Fluxion there needs nothing but to write the Letters without the Dots.

Thus the flowing Quantities of \dot{x} , \dot{y} , \dot{z} , are x , y , z , To find the flowing Quantities belonging to the FLUXION of the Product of two Quantities.

Divide each Number of the Fluxion by the fluxionary Quantity, or Letter, or change the fluxionary Letter into the proper flowing Quantity of which it is the Fluxion; the Quotient connected by their proper Signs will be the flowing Quantities sought.

Only, if the Letters be all exactly the same, the flowing Quantity will be a simple one, whose Parts are not to be connected together by the Signs + and -.

To find the flowing Quantity belonging to the Fluxion of any Power either perfect or imperfect, — take the fluxionary Letter or Letters out of the Equation: Then augment the Index of the Fluxion by 1, or Unity: Lastly, divide the Fluxion by the Index of its Power so increased by Unity.

Thus suppose $3x^3$ proposed; by taking away x it will be $3x^2$: and by increasing its Index by Unity, it will be $3x^3$: then dividing it by 3, its now (augmented) Index, the Quotient will be x^3 , the flowing Quantity required.

Again suppose $\frac{n}{m}x^m$ a Fluxion proposed: By taking away the fluxionary x , it will be $\frac{n}{m}x^{m-1}$: By augmenting the Index by Unity (*i. e.* by taking away -1) it will be $\frac{n}{m}x^m$:

And lastly, by dividing the remaining Part of the Fluxion by $\frac{n}{m}$, prefixed to, or multiplied into x the Quotient will be $x^{\frac{n}{m}}$; which is the flowing Quantity sought.

The Method of Fluxions is the same with that *de Maximis, Minimis, Tangents, &c.*

MAXIMUM in *Algebra* denotes the greatest Quantity attainable in any given Case; and MINIMA the smallest Quantities attainable in any Case.

The Method *de Maximis & Minimis*, is that whereby Mathematicians arrive at the greatest or least possible Quantity attainable in any Case.

If the Semi-ordinates (which are the Halves of the Ordinates or Applicates) of any Curve continually increase or decrease to some certain Term, which once passed, they begin again to increase or decrease, the Method whereby their *Maxima & Minima*, *i. e.* their greatest and least States is determined, is called the Method *de Maximis & Minimis*; which it is true, may be used to determine other Quantities that increase or decrease to any certain Term: But then they must always be represented by the Semi-ordinates of Curves.

If a flowing Quantity in an Equation be proposed to be determined to any extreme Value. — The Rule is; having put the Equation into Fluxions, let the Fluxion of that Quantity (whose extreme Value is sought) be supposed $= 0$; by this Means all those Members of the Equation, in which it is found, will vanish, and the remaining ones will give the Determination of the *Maximum* or *Minimum* desired.

The Reason of the Rule is, that every *Maximum* or *Minimum*, is in its own Nature a stable Quantity: To determine thereof any flowing Quantity to a *Maximum* or *Minimum*, is to make it (instead of a flowing) a permanent one; but the Fluxion of a permanent Quantity is equal to nothing. — This we shall illustrate by an Example or two.

To determine the greatest or least Applicate in an algebraick Curve. Since in Curves they have a *Maximum* and a *Minimum*, the Tangent degenerates at length, and becomes parallel to the Axis, and so the Perpendicular concludes with the greatest or least Applicate, in the Case of *Maximum* and *Minimum* the Subtangent becomes infinite, and the Sub-normal equal to nothing, but $= y dy : dx$. If then $y dy : dx = 0$; we shall find $dy = 0$, and because of $= y dx : dy = \infty$ (the Note of Infinity) $dx = \infty$.

It is possible for the Tangent, to lie directly against the Semiordinate; in which Case the Sub-tangent is equal to nothing, and the Sub-normal infinite. But $= y dx : dy = 0$; therefore if $y dx : dy = 0$ we shall have $dx = 0$; or because of $= y dy : dx = \infty$ we find $dy = \infty$ both dx and y , being, in respect of dy , Infinite-smalls. From the Equation of the Curve therefore we are to find the Value of dy , which is to be made equal either to nothing, or to Infinity, that we have the Value of the Abscisse to which the greatest Applicate is Co-ordinate.

To cut a Right-Line in such a Manner that the Rectangle shall be the greatest that can possibly be thus constructed. Let $= a = x$, then will $= a - x$; consequently $= ax - x^2$ some *Maximum*; and hence its Differential will be equal to nothing, as being conceived at a Circle, to which

$$\begin{aligned} ax - xx &= yy. \\ \text{Wherefore } a dx - 2x dx &= 2y dy = 0 \\ \frac{a - 2x}{2} &= 0 \\ \frac{d}{dx} a &= x \end{aligned}$$

The Line therefore is to be cut into two equal Parts; and the Square is the greatest of all Rectangles, whose Altitudes, taken together, are equal to each other.

TANGENT is a Right-line which touches a Circle, that is, meets in such Manner, as that, though infinitely produced, it would never cut the same; that it never comes within the Circumference.

TANGENT of a Conic Section, as of a Parabola, is a Right-line which only touches or meets the Curve in one Point, and does not cut or enter within the Curve.

Method of TANGENTS, a Method of determining the Quantity of the Tangent of any algebraick Curve; the Equation defining that Curve being given.

the Value of $a = \frac{2vv}{b-2y} = AC$. And so the Point C is found, from whence the *Tangent* DC may be drawn.

To determine which Way the *Tangent* is to be drawn, whether towards B or E, he directs to consider the Numerator and Denominator of the Fraction, For, 1. If in both Parts of the Fraction, all the Signs are affirmative; or if the affirmative ones are more in Number; then the *Tangent* is to run towards B. 2. If the affirmative Quantities are greater than the Negative in the Numerator, but equal to them in the Denominator, the Right-line drawn thro' D, and touching the Curve in that Point, will be parallel to AB: for in this Case, a is of an infinite Length. 3. If in both Parts of the Fraction, the affirmative Quantities are less than the Negative, changing all the Signs, the *Tangent* must be drawn now also towards B: For this Case, after the Change, comes to the same as the first. 4. If the affirmative Quantities are greater than the Negative in the Denominator, but in the Numerator are less, or *vice versa*, then changing the Signs in that Part of the Fraction, where they are less, the *Tangent* must be drawn a contrary Way, that is, AC must be taken towards E. 5. But whenever the affirmative and negative Quantities are equal in the Numerator, let them be how they will in the Denominator, a will vanish into nothing; and consequently, the *Tangent* is either AD itself, or EA, or a Parallel thereto; as will easily be found by the Data. This he gives plain Examples of, in Reference to the Circle; thus: Let there be a Semicircle, whose Diameter is EB, in which there is given any Point; from which the Perpendicular DA is let fall to the Diameter. Let DA = v , BA = y , BE = b ; then the Equation will be $by - yy = vv$, and drawing the

Tangent DC, we have AC, or $a = \frac{2vv}{b-2y}$ Now, if b be greater than $2y$, the *Tangent* must be drawn towards B; if less, towards E; if it be equal to it, it will be parallel to EB, as was said in the first, second, and fourth Rules.

Let there be another Semicircle inverted; as NDD, the Points of whose Periphery are referred to the Right-line BE, parallel and = to the Diameter. Let NB be called d ; and all Things else as before; then the Equation will be $by - yy = dd + vv - 2dv$; which being managed according to his Rules, you have $a = \frac{2vv - 2dv}{b - 2y}$

Now, since v is here supposed to be always less than d ; if b be greater than $2y$, than the *Tangent* must be drawn towards E, if equal, it will be parallel to BE; if less, changing all the Signs, the *Tangent* must be drawn towards B, as by Rules, fourth, fifth, and third.

But there could be no *Tangent* drawn, or at least EB would be it, if NB had been taken equal to the Diameter.

Let there be another Semicircle, whose Diameter NB is perpendicular to EB, and to which its Points are supposed to be referred. Let NB be called b , and all the Things else as above; the Equation will be $yy = bv - vv$, and $a = \frac{bv - 2vv}{2y}$ If now b be greater than $2v$, the *Tangent* must be drawn towards B, if lesser, towards E, if equal, DA will be the *Tangent*, as by Rules 1, 4, and 5 appears.

Inverse Method of TANGENTS, is a Method of finding the Equation, or the Construction, of any Curve; from the *Tangent*, or any other Line, whose Determination depends on the *Tangent* given.

This Method is one of the great Results of the new *Calculus integralis*.

Its Application we shall give in what follows.—The differential Expressions of the *Tangent*, *Sub-tangent*, &c. being delivered under the last Article; if you make the given Value equal to the differential Expression, and either sum up the differential Equa-

tion, or, if that cannot be, construct it, the Curve required, is had. For Example:

1. To find the curve Line, whose Sub-tangent = $2yy : a$.

Since the Sub-tangent of an Algebraic Line is $= ydx : dy$ we have

$$\begin{array}{r} ydx : dy = 2yy : a \\ aydx = 2y^2dy \\ adx = 2ydy \\ ax = y^2 \end{array}$$

The Curve sought therefore is a Parabola.

2. To find the Curve, whose Subtangent, is a third Proportional to $r - x$ and y .

$$\text{Since } r - x : y = y : \frac{ydx}{dy}$$

$$\begin{array}{r} \text{We have } r - x : y = dy : dx \\ rdx - xdx = ydy \\ rx - \frac{1}{2}x^2 = \frac{1}{2}y^2 \\ 2rx - xx = y^2 \end{array}$$

The Curve sought therefore, is a Circle.

3. To find a Line, wherein the Sub-tangent is equal to the Semiordinate.

$$\begin{array}{r} \text{Since } ydx : dy = y \\ ydx = ydy \\ dx = dy \\ x = y \end{array}$$

Hence it appears, that the Line sought, is a Right-Line, which respects the Cathetus of an equicrural Triangle, as an Axis, or the Hypothenuse of an equicrural, rectangled Triangle. If x had been taken for the Arch of a Circle, the sought Line had been a Cycloid.

As to the Origin of this Art, we are much in the Dark.—The Invention is usually attributed to *Diophantus*, a Greek Author, who wrote thirteen Books, though only six of them are extant, first published by *Xylander*, in 1575; and since commented on and improved by *Gasper Bachet*, of the French Academy, and since by *M. Fermat*.

And yet *Algebra* seems to have been wholly unknown to the ancient Mathematicians, long before the Age of *Diophantus*: We see the Traces, the Effects of it, in many places; though it looks as if they had designedly concealed it.—Something of it there seems to be in *Euclid*, or at least in *Theon* upon *Euclid*, who observes, that *Plato* had begun to teach it.—And there are other Instances of it in *Pappius*, and more in *Archimedes* and *Pollonius*.

But the Truth is, the Analysis used by those Authors is rather Geometrical than Algebraical, as appears by the Examples thereof, which we find in their Works: So that we make no Scruple to say, that *Diophantus* is the first and only Author among the Greeks who has treated of *Algebra* professedly.

This Art, however, was in Use among the Arabs much earlier than among the Greeks. And it is said that the Arabs too borrowed it from the Persians, and the Persians from the Indians; it is added, that the Arabs carried it into Spain, whence some are of Opinion, it passed into England, before *Diophantus* was known among us.

The first who wrote on the Subject in this Part of the World, was *Lucas Pacciolus*, or *Lucas de Burgos*, a Cordelier; whose Book, in Italian, was printed at Venice in 1494.—This Author makes Mention of one *Leonardus Pisanus*, and some others, of whom he had learned the Art, but we have none of their Writings.—He adds, that *Algebra* came originally from the Arabs; and never mentions *Diophantus*; which

which makes it probable, that that Author was not yet known in *Europe*.—His *Algebra* goes no farther than simple and quadratick Equations.

After *Pacciolus*, appeared *Stifelius*, a good Author; but neither did he advance any further.

After him came *Scipio Ferreus*, *Cardan*, *Tartaglia*, and some others; who reached as far as the Solution of some cubick Equations.—*Bombelli* followed these, and went himself a little further.—At last came *Nunnius*, *Ramus*, *Schoner*, *Salignac*, *Clavius*, &c. who all of them took different Courses, and none of them went beyond Quadratics.

About the same Time, *Diophantus* was first made publick; whose Method is very different from those of the *Arabs*, which had been followed till then.

In 1590, *Vieta* entred on the Stage, and introduced what he called his *Specious Arithmetick*, which consists in denoting the Quantities both known and unknown, by Symbols or Letters.—He also introduced an ingenious Method of extracting the Roots of Equations, by Approximations; since much facilitated by *Ralphson* in his *Analysis Aequationum*.

Vieta was followed by *Oughtred*, who in his *Clavis Mathematica*, printed in 1631, improved *Vieta's* Method; and invented several compendious Characters, to shew the Sums, Differences, Rectangles, Squares, Cubes, &c.

Mr. *Harriot*, another *Englishman*, cotemporary with *Oughtred*, left several Treatises at his Death; and among the rest an *Analysis*, or *Algebra*, which was printed in 1631; where *Vieta's* Method is brought into a still more commodious Form, being that which obtains to this Day.

In 1657, *Des Cartes* published his Geometry, wherein he made Use of the literal Calculus, and the *Algebraick* Rules of *Harriot*; and as *Oughtred* in his *Clavis* and *Marin*. *Ghetaldus*, in his Book of Ma-

thematical Composition and Resolution, published in 1630, applied *Vieta's* *Arithmetick* to elementary Geometry, and gave the Construction of simple and quadratick Equations, and adding the Constructions of cubick, biquadratick, and other higher Equations.

Des Cartes's Rule for constructing cubick and biquadratick Equations, was further improved by *Thomas Baker*, in his *Clavis Geometrica Catholica*, published in 1634; and the Foundation of such Constructions, with the Application of *Algebra* to the Quadratures of Curves, Questions *de maximis* and *minimis* the centrobarye Method of *Guldinus*, &c. was given by *R. Slusius* in 1668; as also by *Fermat*, in his *Opera Mathematica*; *Roberval* in the *Mem. de Mathem. & de Physique*; and *Barrow*, in his *Lect. Geomet.*—In 1708, *Algebra* was applied to the Laws of Chance and Gaming, by *R. de Montmort*, and since by *De Moivre*, and *James Bernoulli*.

Thus much for the Progress of *Algebra*.—The *Elements of the Art* were compiled and published by *Kersey* in 1671; wherein the *Specious Arithmetick*, and the Nature of Equations are largely explained, and illustrated by Variety of Examples: The whole Substance of *Diophantus* is here delivered; and many Things added concerning mathematical Composition and Resolution, from *Ghetaldus*. The like has been since done by *Prestet*, in 1694; and by *Ozanam* in 1703. But these Authors omit the *Algebra* to Geometry, which Defect is supplied by *Guisne*, in a *French* Treatise expressly on the Subject, published in 1704; and *L'Hopital* in his analytical Treatise of the conick Sections, in 1707.—The Rules of *Algebra* are also compendiously delivered by *Sir Isaac Newton*, in his *Arithmetica Universalis*, first published in 1707, which abounds in choice Examples, and contains several Rules and Methods invented by the Author.

ANABAPTISM.

ANABAPTISM from *ἀνα*, *denuo*, again; and *βαπτισμα*, I baptize, is a religious *Sect* whose distinguishing Tenet, is, that Children are not to be baptized, till they arrive to Years of Discretion, that they may give Reason of their Faith before they can receive a regular Baptism.

This Definition don't answer very well the Etymology of *Anabaptism*; and in Fact the *Anabaptists* of these Days, are but improperly called *Anabaptists*. The *Novatians*, *Cataphrygians* and *Donatists* were the true *Anabaptists* of the primitive Church; since they used to re-baptize all those who had been baptized out of their Communion; and considered all other Baptism, which was not conferred by some of their *Sect*, as null.

This Opinion was one, if not the principal Pretext of the Schism of the *Donatists*, and afterwards of their entire Separation from the Church. They could not believe, or else pretended so, that the Baptism conferred by Hereticks was valid, or that any Body could be initiated into the Church, by those who were excluded from it.

This new Opinion caused a great deal of Confusion and Trouble in the *African* Church; and was followed afterwards, by some very eminent Bishops of the same Church, even by those who had Zeal enough to seal their Faith with their Blood; *St. Cyprian* is one of them; he declares openly his Sentiment on that Subject, which is so agreeable to that of *Donatus*, that *St. Augustin* reproaches him publicly with being a *Donatist*; which was the Occasion of a long Dispute between the *Partisans* of those two great Lights of the Christian Church, conducted with much Warmth on both Sides, and which lasted till *St. Cyprian's* Death.

This Mistake of *St. Cyprian*, (for it was certainly one) was rather to be attributed to the Excess of his Zeal, and to his too great Severity, than to any Desire of making or fomenting any Innovation in the Church. The Opinion was new, it is true, and even proceeded from a very corrupted Source, and what in all Appearance, rendered him less excusable, is, that the *Donatists* had been anathematized in two Councils, one held at *Rome* two Years after their Separation, and the other at *Arles*, the Year following; but *St. Cyprian* was not, perhaps, fully convinced, that the Tenet of the *Donatists*, as to rebaptizing the *Hereticks*, had deservedly incurred the Censure of those two Councils; he himself condemns the *Donatists* in all their other Articles, but this; and to convince the *Augustinians* that he was neither Heretick himself, nor a Favourer of Hereticks, but only acted on that Occasion, according to the Dictates of his Conscience, and profound Knowledge, he shewed himself a declared Enemy of the *Donatists*, and had the Decrees of the two Councils executed against them, with the utmost Severity; though in the mean Time, he defended their Opinion *de Rebaptizandis Hereticis*, against *St. Augustin*. The Proofs he employs to support it, are a certain Evidence of the great Penetration and Strength of Reasoning of *St. Cyprian*; but are neither supported by the Scripture, nor the Tradition, nor the Practice of the primitive Church; since there is no other essential Condition required, even by *Christ* himself, who instituted it, than the baptizing in the Name of the *Father*, *Son*, and *Holy Ghost*, neither the Church thought fit to declare, that the Efficacy, or In-efficacy of that *Sacrament*, depended on the Worthiness, or Unworthiness of the *Minister*. A *Sacrament* is a visible Sign, or Symbol, of an invisible

Grace, if that Symbol is administered according to the Intention of the *Divine Institutor*, no Doubt but it is accompanied with what is represented. In the Administration of the Lord's Supper, for Example, the Worthiness of the Minister, cannot procure the Efficacy of the Sacrament, if he that receives it is unworthy; since the Efficacy of that Sacrament proceeds *Ex opere operantis*, i. e. conditionally to the Disposition of the Person that receives it. Why should then the Unworthiness of the Minister, frustrate the Baptism of its Efficacy; which is *Ex opere operato*, i. e. confers the Grace of itself? and consequently confers the Grace, without any Regard to the Worthiness or Unworthiness of the Person baptized, much less to that of the Minister of the Baptism.

The primitive Church was so well convinced of this Truth, that they thought every Body capable of administering Baptism, in Case of Necessity, a *Physician*, a *Midwife*, or any other Person of both Sexes, without even excluding a Pagan *Executioner*, or any other like Minister, who could baptize a *Martyr* with his Blood, which Baptism the Church called *Baptismus sanguinis*.

But Hereticks are excluded, or rather banished the Church, and thereby incapable of initiating others into it? To which it may be answered, that that Exclusion is but temporal, and conditional, i. e. till they abjure their Errors; and only from the Congregation of the Faithful: But that Exclusion don't deprive them of their first Initiation into the Christian Church, by Baptism, which is an *indelible Character*, and which consequently they can confer on others.

St. *Cyprian* himself could not have been persuaded that a Bishop or a Priest, suspended *ab officio*, was thereby deprived of the Power he received at his Consecration, or Ordination; or that he was to be re-consecrated, or re-ordained, before he could re-assume his Functions; therefore I must say of St. *Cyprian*, with St. *Augustin*, *De rebaptizandis Hereticis*, *non credo quod credidit CYPRIANUS, quia non credit Ecclesia, pro quâ CYPRIANUS sanguinem suum fudit*, i. e. as to re-baptizing Hereticks, I do not believe what *Cyprianus* believed, because that Church, for which *Cyprianus* has spilt his Blood, does not believe it.

There were also different Sects of *Anabaptists*, or *Re-baptizans* in the twelfth Century, such as the *Petrobrussians*, *Waldenses*, and *Albigenses*.

The *PETROBRUSSIANS*, so called from their Leader *Peter Bruys*, a Provincial, appeared in *France* and the *Netherlands*, about the Year 1126.

The next to *Bruys* was a Monk, one *Henry*, from whom the *Petrobrussians* were also called *Henricians*.

Their chief Opinion, together with many others they were reproached with by *Peter de Clugny*, was, that they denied that the Children before the Age of Reason, could be justified by Baptism; in Regard that it is our own Faith that saves by Baptism.

The *Waldenses* and *Albigenses* agreed in this Article, as well as in many others, with the *Petrobrussians*.

Peter de Bruys was the first who gave Rise to the *Albigenses*, thus called from their having first appeared at *Alby* in *Languedoc*.

These *Albigenses* grew so formidable in a little Time, that a *Croizade* was preached against them by one Father *Dominick*, Native of *Bolonia* in *Italy*, and Founder of the *Dominican Fryers*, otherwise called *Jacobins*. Some Authors pretend that the Pope himself raised the first Standard against them; but nothing contributed more to their Reduction, than the Inquisition, established at *Thoulouse*, upon the Model proposed by the same Friar *Dominick* for that Purpose. The Truth is, that under Pretence of Religion, they committed a vast Number of Disorders, which were not to be suffered, either by their own Sovereign, or by the other neighbouring Princes.

The *Anabaptists* of this present Time, are a Sect of Protestants who first appeared in the sixteenth Century, in some Provinces of *Germany*, particularly *Westphalia*, where they committed several Outrages.

They taught that Baptism was not to be conferred on Children; that it is unlawful to war or bear Arms, which Opinion, they also supported with this Passage of St. *Cyprian*, *non militabis*, go not to War; that a true Christian cannot be a Magistrate, &c.

Some pretend, that *Carlostad* was the Author of this Sect; others, *Zuinglius*. *Cocklaus* says, it was *Balibazar Pacimontanus*, who begun to teach in 1527, and was burnt at *Vienna* some Time afterwards.—*Mezorius* affirms it was first broached by *Pelargus* in 1522, seconded by *Stubner*, *Bodenstein*, *Carlostadius*, *Westenberg*, &c. &c.

But the common Opinion is, that *Thomas Munster*, or *Munzer*, is their first Patriarch, who, deviating from the primitive Christian Simplicity, (he pretended to revive) declared himself King of the *Anabaptists*. *Munster* was a Native of *Zwickau*, a City of *Misnia*, and had been originally a Disciple of *Luther*, from whom he took Occasion to separate, under Pretence that his Doctrine was not perfect enough; that he had only carried the Reformation half-way, and that to arrive at the true essential Religion of Christ, immediate Revelation must be added to the dead Letter of the Scripture.—A Doctrine, in Fact, quite opposite to the true Principles of the Reformation, which were, that every Christian could instruct himself in the Scripture (without any other Assistance) of all that's requisite for his Salvation; looking on immediate Revelation, as on the Gift of Miracles, as entirely ceased, ever since the Time of the Apostles.

Munster took for his Coadjutor or Associate, in his pretended Mission, *Nich. Strock*, or *Pelargus* of *Halberg* in *Saxony*; and though these two Persons were not the first Inventors of their Doctrine, they however appear to have been the first Teachers or Propagators thereof.

We have the best Account of the Origin of the *Anabaptists*, in the historical Commentaries of *Sleidan*.—He observes that *Luther* had preached up so strenuously for the evangelical Liberty, that the Peasants of *Suabia* flocking together, leagued themselves against the ecclesiastical Powers, on Pretence of defending the evangelical Doctrine, and shaking off the Yoke of Servitude. *Luther* wrote them several Letters of Exhortation to lay down their Arms; but if himself, under-hand and secretly, did not encourage them in their Revolt, as supposed by the most impartial Authors of those Times; or rather if *Luther*, was not sorry they had taken them in the Defence of two of his Disciples who had apostatized from him, is what *Sleidan* has left undecided: However, in Answer to his charitable and truly christian Exhortations, they retorted his own Doctrine upon him; maintaining, that having been made free by the Blood of Christ, it was injurious to the Name of Christians, that they had hitherto been reputed Servants.—A Doctrine very agreeable to this Advice of Christ himself, *reddite quæ sunt Cæsaris, Cæsari*, render to *Cæsar* the Things that are *Cæsar's*.—And to this other of the *Apostle*, *obedite Præpositis vestris*, obey them that are set over you.—And consequently founded on the first Principles of Christianity.—Accordingly they proclaimed every where, that they only took up Arms, by Reason they esteemed themselves obliged thereto by Commandment of God; but where to find that Commandment, is what could not have been easily done.

Luther finding all his Exhortations ineffectual, published a Book wherein he invited all the World to take up Arms against those Fanaticks, who thus abused the Word of God.—He was obliged soon after to write a Second, to justify his Conduct, which to many, appeared too severe, and even cruel.

The *Anabaptists*, to the Number of forty Thousand ravaged all the Places where ever they came, (no doubt through a Principle of a truly Christian Charity, and to re-establish the Kingdom of Christ, upon its first Foundation.) Some Authors are of Opinion that *John* of *Leyden*, who headed them, then declared himself their King, but it is an Error, since

Munster had took that Title at his first setting out, and *John of Leyden* was but his General; though, at the same Time, he never used to stir out, or appear in publick, without a large Retinue of principal Officers: Two young Men rode always immediately after him, the one bearing a Cap, made in the Form of a Crown, and the other a naked Sword.—Their Pretence was, to establish the new Reign of *Jesus Christ* on Earth, who says positively, *That his Kingdom is not of this World.*—Who, while living, had not so much as a Place to rest his Head upon.—And who reprimanded *Peter* for having drawn his Sword in his Defence; though at the same Time they were pleased to condemn all Use of Arms for other purposes.

Calvin wrote a Treatise against the *Anabaptists*, still extant in his *Opuscula*; though he was possessed with the same Ambition, and had found the Secret to render himself almost absolute at *Geneva*.—What they chiefly supported their great Doctrine on, was those Words of our Saviour, *He that believes and is baptized shall be saved*, Mark xvi. 16. As none but Adults are capable of believing, they argue that no others were capable of Baptism; especially as there is no Passage in all the New Testament where the Baptism of Infants is clearly enjoined.—*Calvin*, and other Writers who have wrote against them, are pretty much embarrassed to answer this Argument. Though we find in several Places of the same Book, the *Generation of Water*, and of the *Holy Ghost*, as indispensably necessary for Salvation, and no Reason why Infants should run the Risque to die without that Regeneration; and as it has always been the common Opinion of the Christian Church from its Infancy, that by the original Sin, we were excluded from the Kingdom of Heaven, and the Baptism instituted for the Ablution of that Sin, consequently that Ablution was as necessary to Infants, as to the Adults.—Those that object against infant Baptism, pretend that on such Occasion the Faith of Parents supply the Defect of the Ceremony.

'Tis true that the Church has acknowledged a Sort of Baptism which they called *Baptismus Flamini*; but it was only in Time of Persecution, when *Catechumens*, died in Prison, or by some other Accident, before they could have been baptized; but when such Things happen'd through the Obstinacy or Negligence of Parents, (when the Baptism of Water, or *Fluminis* can be so easily administered, without the least Danger) That of *Flaminis*, has never been thought sufficient. Besides the Infant-Baptism is mentioned by *Origen*; by the Author of the Questions attributed to *Justin* the Martyr, in a Council of *Africa*, spoke of by *St. Cyprian*, where the Baptism of Infants immediately after they were born was expressly enjoined; and in several other Councils of *Autun*, *Mascon*, *Girone*, *London*, *Vienna*, &c. Besides other Fathers, as *St. Irenæus*, *St. Jerom*, *St. Ambrose*, *St. Austin*, &c.

It must be added that several Arguments may be drawn from the Scripture against the *Anabaptists*, to which the *Anabaptists* will answer, that the Children mentioned in *Mark* x. 14. and *Luke* xviii. 16. were grown big since they could come to him; and consequently were capable of an Act of Faith; but this is contrary to the express Terms of the Scripture, which in *St. Matthew*, and *St. Mark*, calls them *παιδῶν*, *Children*, and in *St. Luke* *παιδῶν*, *little Children*: The same *St. Luke* writes that they were brought to *Jesus*; which is a Presumption that they were not yet able to walk.

Though I must confess that these Passages of the Evangelists are not a very strong Argument for the Infant-Baptism. Since *Jesus Christ* may be supposed to speak rather of the Innocency of those Children which rendered them fittest to inherit the Kingdom of Heaven, than of their being fit to be baptized.

This other Passage of the Apostle *St. Paul* to the *Romans* v. 17. is a great deal stronger, "If by one Man's Offence Death reigned, says he; much more

"they who receive abundance of Grace, and the Gift of Righteousness shall reign in Life by one *Jesus Christ*;" for if one become criminal by one, then are Children criminal; consequently if all are justified by one, then are Children justified; but this cannot be without Faith; and consequently Children may have the Faith required for the receiving of Baptism, *i. e.* an actual Faith preceding the Sacrament, as a Disposition requisite thereto. This Faith they have not of themselves, but by others, *viz.* their Parents, or their Godfathers and Godmothers, who answer for them.—Nor is there any thing in the whole Dispensation, but what is very equitable: It being but just, that as they had sinned in the Will of another; they might also be justified by the Will of another. Neither is there any more Inconveniency in this Profession of Faith made by Proxy, than in that made by those baptized at the Age of Discretion, and who can answer for themselves; on the contrary, there is, in my Opinion, more to be feared that an Adult, over whom his Passions have gained a greater Ascendant, and who is more exposed to Temptations, could be persuaded to renounce the Faith he has professed in his Baptism, than an Infant, who being born of Christian Parents, is instructed in his Faith, as soon almost as he begins to know his Existence, being made acquainted with his Religion as soon as his Reason is capable of the least Instruction.

The Impressions he received then, which we call Prejudices of Infancy, must be a great deal stronger than those made on the Mind of an Adult, whose Reason, which he is in a Condition to consult, revolt often against what's above her Apprehension.

The *Anabaptists* adopted several other Dogmata from the *Gnosticks*, &c. touching the Incarnation, &c. but their favourite Opinion, was that of being directed by a secret and divine Inspiration to establish the Kingdom of *Jesus*, on the Ruin of all Sorts of Government whatever, in Hope that *Jesus* being an invisible King, they could appoint themselves his Lieutenants.

As they multiplied, they divided into a great Number of *Sects*; which took particular Denominations either from the Leaders thereof, or the peculiar Opinions they superadded to the general System of *Anabaptists*.—The Principal were the *Muncerians*, *Catharists*, *Enthusiasts*, *Silentes*, *Adamites*, *Georgians*, *Independants*, *Hussites*, *Melchiorites*, *Nudipedalians*, *Mennonites*, *Bulboldians*, *Augustinians*, *Servetians*, *Monasterians*, *Libertins*, *Deorelietians*, *Semperorantes*, *Polygamites*, *Ambrosians*, *Clancularians*, *Manifestarians*, *Babalarians*, *Pacificators*, *Pastoricides*, *Sanguinarii*, &c.

But all those different *Sects*, were re-united, or rather confounded, towards the Beginning of the 17th Century, into that of the *Independents*, a *Sect* so called, as denying not only any Subordination among their Clergy, but also all Dependency on any other Assembly.

They maintain that every separate Church, or particular Congregation, hath in itself radically and essentially every Thing necessary for its own Government; that it has all ecclesiastical Power and Jurisdiction, and is not at all subject to other Churches, or their Deputies, nor to their Assemblies or Synods.

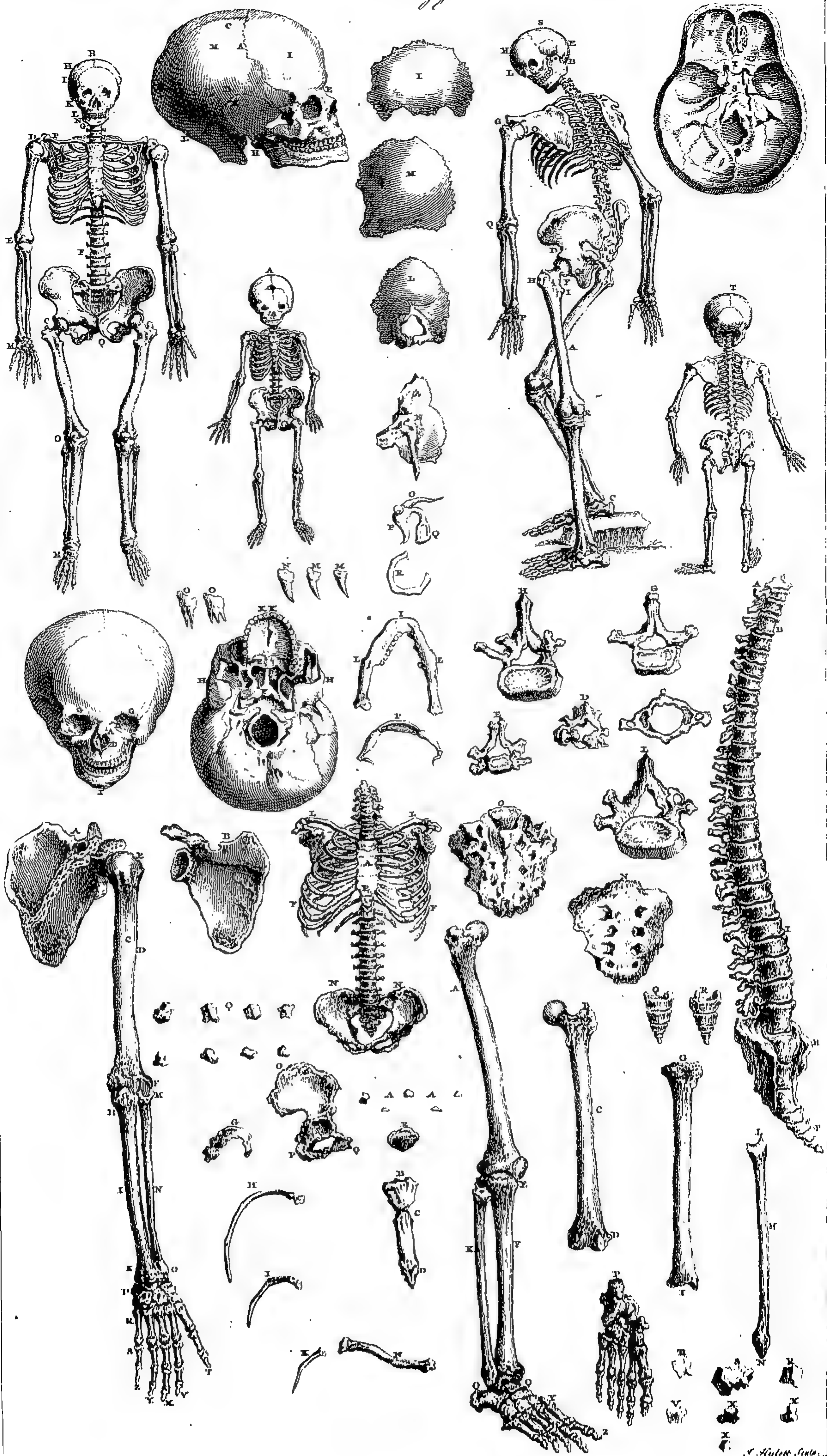
Though the *Independents* do not think it necessary to assemble Synods; yet if any be held, they look on their Resolutions as weighty and prudential Counsels, but not as Decisions to be peremptorily obeyed.

They agree that one or more Churches may help another Church with their Advice and Assistance, and even reprove it when it offends; provided they do not pretend to any superior Authority, or Right to Excommunicate, &c.

In Matters of Faith and Doctrine the *Independents* agree with the rest of the reformed, so that the Difference is rather Political than Religious.

During the Civil Wars in *England*, the *Independents* becoming the most powerful Party, and getting to the

Osteology



the Head of Affairs, most of the other Sects, that were averse to the Church of *England*, joined them; which occasioned them to be distinguished into two Sects.

The first are in Effect Presbyterians, only differing from them in Matter of Discipline; for though, like the *Independents*, they allow of no Hierarchy, of no Subordination in the Persons of their Ministers; and maintain, that Bishops and Priests in the Times of the Apostles, were the same, they nevertheless, have a Series of Assemblies or Synods; every Minister is obliged to be obedient to the *Classis* under which he lives; and that Class to a Synod Provincial, Classical, or Oecumenical.

The Power of Ordination, with them, resides in a *Classis*, and none are admitted to administer the Sacrament, but those ordained by the Imposition of Hands of other Ministers.

They make Use of Deacons to take Care of their Poor; and in the Government of the Church, call in Lay-Elders.

This is now the reigning Discipline in the Church of *Scotland*, as it was during the *Inter-regnum* in *England*.

Father *Orleans* speaks of the Rise of the *Independents* in the following Terms. "Out of the same Sect (the *Anabaptists*) had risen some Time ago a new Sect, not only averse to the Monarch, but to Monarchy, both which it undertook to destroy, and in lieu thereof to form a Republick.— They were called by the Name of *Independents*, in Regard that professing to carry the Gospel Liberty still further than the other *Puritans*, they rejected not only Bishops, but also Synods, pretending each Assembly ought to govern itself, in-

pendently of all others; in which, said they, consists the Liberty of the Children of God. At first they were only distinguished among the Presbyterians, as the more zealous from the more indifferent, the more rigid from the more remiss, by a greater Aversion to all Pomp and Pre-eminence, both in Church and State; and by a more ardent Desire to reduce the Practice of the Gospel to its primitive Purity. It was their Maxim of *Independency* that first distinguished them, and rendered them suspected of the Rest: But they had Address and Artifice enough to gain Ground, and in Effect made Abundance of Proselytes out of all other Parties and Persuasions."

Independentism is peculiar to *Great Britain*, the *British Colonies*, and the *United Provinces*. One *Morel*, in the sixteenth Century, endeavoured to introduce it into *France*; but it was condemned at the Synod of *Rochel*, where *Beza* presided; and again at the Synod of *Rochel*, in 1644.—Though the *French* Protestants agreed with the *Independents* in the most material Point, and in their civil Wars under *Charles IX*, and *Henry III*, had shewed plainly, that they were declared Enemies of Monarchy, and of monarchical Government; but they had among them a Sort of Subordination, and *Beza* with their other Reformers had usurped to themselves a Sort of Supremacy, they could never have been persuaded to renounce.

Those who now retain the Name of *Anabaptists*, have abandoned the greatest Part of their ancient Dogmata; and in lieu of the fanatick Zeal of their Founders, have given into an exemplary Simplicity in their Morals, Actions, Discipline, Dress, &c.

ANATOMY.

ANATOMY is an artificial Dissection of a Body, in order to know the Parts which compose it.

ANATOMY is divided into two Parts, *Osteology* and *Sarcology*.

The first treats of the Bones, and Cartilages; and the second of the Flesh, and other soft and tender Parts.

OSTEOLOGY, from the *Greek*, *ὀστέον*, a Bone, and *λόγος*, a Discourse, contains an exact Disquisition of what belong to the Bones in common, and what to each in particular; but before we enter into that Disquisition, we must consider their Definition, their Differences, their Articulations, their Causes, their Parts, and their Number.

A Bone is defined by *Galen*, to be the hardest, the driest, and most terrestrious Part of the whole Body; and, by me, the hardest and most solid Part of the Body of an Animal.

The Differences of the Bones, consist in their Substance, Quantity, Figure, Situation, Uses, Motion, Sense, Generation, and Cavities.

They differ in their Substance, because there are Bones which have a very hard Substance, as the *Tibia*; others less hard, as the *Vertebrae*; and some are soft and spongy, as the *Sternum*.

In their Quantity, because their Number is very great, and all the Bones are not equal; for some are large, as those of the Arms and Legs; some of a moderate Dimension, as those of the Head; and some small, as those of the Fingers.

The Figure of the Bones is as different as there are Bones in the Body; some are long, as the *Femur* or the *Tibia*; others short, as the Bones of the Wrist, and the Heel; some round, as the *Rotula*; others flat, as that of the Palate; others square, as the *Os Parietalia*; and some triangular, as the first Bone of the *Sternum*.

As for their Situation, some are placed in the

Head; others in the Trunk of the Body; and others in the Extremities; with this Observation, that among those of the Head, some have a deeper Situation, as the three *Officula* of the Hearing; and others a more superficial, as those of the *Cranium*.

The Bones have also different Uses, some serving to support the Body, as those of the Thighs, and Legs; other to contain Parts, as the *Goffe*; and others both to contain and defend, as the Bones of the *Cranium*.

Their Motion is either manifest, as that of the great Bones of the Extremities; or a secret one, as that of the Wrist, and the Heel; and some have no Motion at all, as the Bones of the Head.

None of the Bones have any Sensation, except the Teeth.

The Bones differ in their Generation; and Perfection, because some of them do grow to Perfection even from the Mother's Womb; such as the small Bones that lie in the Cavities of the Ear; and others are only perfected with Time and Years, as all the Bones of the Body: Of these some harden sooner, as the lower Mandible; and some later, as those of the *Vertex*, or Top of the Head.

The last Difference is taken from the Cavities of the Bones; for some of them have very large Cavities for the Reception of the Marrow, as those of the Extremities of the Body; and some have only Porosities which contain a medullary Juice, as the *Calcaneum*; again, some of them have Holes for Transmission of the Vessels, as the Bone of the Basis of the *Cranium*, and the *Vertebrae*; others have only a Hollowness as the *Os Sternum*, and some Sinus's, as the *Os frontis*, and *Temporum*; and lastly, some consist of Abundance of little Holes like a Sieve, as the *Os Ethmoides*.

The Conjunction of the Bones, is either by Articulation or *Symphysis*.

Articulation, is a natural Conjunction of two Bones touching one another by their Extremities.

Symphysis,

Symphysis, is a natural Union or firm Adhesion, as when Bones that were at first, plainly distinct, seem to be grown altogether one Bone.

There are two Sorts of Articulation, one called a *Diarthrosis*, and the other *Synarthrosis*.

The *Diarthrosis* is a Kind of Articulation, in which the Motion is manifest, and is again subdivided into three Sorts, *Enarthrosis*, *Arthrodia*, and *Ginglymus*.

Enarthrosis, is when a large and long Head is received into a deep Cavity, as the Head of the *Femur* is received into the Cavity of the *Os Innominatum*. (C)

Arthrodia, when a superficial Cavity receives a flat Head, as the Head of the *Humerus*, that's received into the glenoid Cavity of the *Scapula*; or the Heads of the *Metacarpus* or *Metatarsus*, into the Cavities of the first *Phalanx*. (D)

Ginglymus, is a third Sort of *Articulation*, in which two Bones receive mutually each other, as the Bone of the *Carpus* is receiv'd into that of the *Cubiti*; and that of the *Cubiti* into that of the *Carpus*. (E)

Synarthrosis, is an Articulation, so firm and so strong, that it has no distinct Motion. (G)

There are also three Sorts of *Synarthrosis*, viz. the *Suture*, *Harmonia*, and *Gomphosis*.

The *Suture*, is when two Bones appear in their Conjunction, as if they had been sown together. There is a true and genuine, and false, or bastard Suture. The true *Suture* (H) is when two Bones are joined like two Saws, whose Teeth meet close together, as the *Offa Parietalia* with the *Os Coronale*; and the false Suture (I), when two Bones are articulated in Form of Scales or *Lamina*, placed one over the other, as the *Parietalia*, with the *Os Temporum*.

Harmonia, is an Articulation whereby the Bones are joined in a simple streight Line, or a circular one, as the Bones of the Face, the Nose, and the Palate. (K)

Gomphosis is a compact Articulation, when a Bone is sunk or driven hard into another, as the Teeth are into their *Alveoli*. (L)

Amphiarthrosis, is a Sort of neutral Articulation, which is neither a *Diarthrosis*, having no manifest Motion, nor a *Synarthrosis*, as being not entirely deprived of it; such is the Articulation of the *Costæ* with the *Vertebræ* of the Back, and such is that of the Bones of the *Carpus* and the *Tarsus* among one another. (M. M.)

Symphysis, which I have said to be a natural Union of Bones, is of two Sorts, either made without some intermediate Substance, or with it.

That without some intermediate Substance, is when we find nothing that makes the Union of two Bones, as the *Epyphysis*, or Appendage, with the principal Bone to which it is joined, as we observe in the Bones of the upper Jaw.

Symphysis, which is made with some intervening Substance, is of three Sorts, *Synneurosis*, *Sysarcosis*, and *Synchondrosis*.

Synneurosis is that Kind of *Symphysis*, which unites Bones by the Means of Ligaments, as the Articulation of the *Rotula*, or *Patella*, with the *Tibia*. In the *Sysarcosis*, Bones are joined by the Flesh, and have no other Ligaments, as the *Os Hioides*, and the *Scapula*.

When Bones are united together by a Cartilage, as the two Bones of the *Os Pubis*, or the Share-bone, such Articulation is called *Synchondrosis*.

The Bones have their Origin or Principle in common with all the other Parts of the human Body, which is the seminal Liquor elaborated by the natural Heat.

Bones are composed of many Parts, of which some are prominent, and some hollow; of the First, there are three Sorts, as the principal Part, the *Apophysis*, and the *Epiphysis*. There are, also, three Sorts of Cavities in them, called either Holes, Pits, or *Sinus*'s.

The principal Part of a Bone, is the hardest and strongest Part of it, it is called the principal Part, because it contains, almost, the whole integral Bone,

and retains the Name of the Whole to itself, having no other Denomination, till one's come to the Extremities, where lye the *Apophysis*, and *Epiphysis*.

Apophysis, is a Protuberance that rises on the Superficies of the Bones with which it has the very same Continuity; such is the Prominence of the *Os Petrosum* called *Apophysis Mastoides*. (B)

The Inequalities of Bones, serve to render their Articulation more convenient; for the *Origination* and Insertion of divers Muscles, and for the Defence of some Parts, as are those of the *Scapula*, and the *Vertebra*.

Epiphysis is an Appendage or an additional Bone, joined to the Principal, by a simple Contiguity; as the Prominence on the *Os Tarsi*. (C)

The Use of the *Epiphyses* is, 1. To strengthen the Articulation; and 2. To serve as well as the *Apophyses*, for the Insertion of divers Muscles and Ligaments, without which there can be no Articulation, and which could not adhere to a Substance harder than the *Epiphyses*.

All *Epiphyses*, are reduced to three Kinds, the Head, the Neck, and the *Corona*.

When a Bone terminates or rises in a great round Branch, it is called the Head, as is that of the *Femur*; but if it be a small Prominence, *Condilus*. Such is that of the lower Jaw, which enters into the Cavities of the *Os Petrosum*. (D) (E).

The Neck (F) is the narrowest Part of the Bone, but from a narrow Beginning dilates itself by Degrees. It is always placed under a Head; the Neck of a Bone differeth from the Head, in that the Head is almost always *Epiphysis*, and the Neck *Apophysis*.

The *Corona*, is when a Bone has a sharp Prominence, which sharp Prominences have divers Figures, and are called by the Name of the Things they most resemble; that in the *Os Petrosum* is called *Styloides*, because made like a *Styletto*; another is called *Mastoides*, because it resembles a Nipple, &c. (G).

The Magnitude of *Epiphyses* is not alike in all the Bones; the *Tibia*, V. G. which is a large Bone, has large ones; and the small Bones, as those of the Fingers, very small ones; one and the same Bone, has some Time, also, *Epiphyses* of a different Bigness, as the *Femur* has a large one called the great *Trochanter*, and another small one, called the lesser *Trochanter*. (H)

The Bones have not all the same Number of *Epiphyses*, for some of them have none at all, as the Bone of the lower Mandible; and others have many, the *Costæ* have each one, the Bones of the Legs and Arms, each two; those of the *Os Ilium*, three; those of the *Femur*, four; and each *Vertebra*, five.

The *Epiphyses* are not always placed at the Extremities of the Bones, but some are found in the Middle of them.

In Infants the Substance of *Epiphyses* is cartilaginous, and doth not acquire the Consistence of a Bone, until after the twentieth Year of the Age.

The *Epiphyses* are covered at their Extremities with a Cartilage; not only to facilitate the Motion of the Joints, but likewise to hinder the Bones from rubbing or grating against one another.

Besides those Prominences, the Bones have also their Cavities, which consist, as I have observed already, in their Holes, Pits, and *Sinus*'s.

A *Hole* is a Cavity that has both Ingress, and Egress, which may be seen in the Cavities at the *Bas* of the *Cranium*, whereof some give an Entrance to the Arteries, and others to let the Nerves and Veins go out. (K)

A *Pit* is a Cavity that has an Entrance, but no Passage out, and whose Brims are raised by small Prominences like little Hills. These Cavities serve to give a Part some Figure, or else to contain something; such is the Cavity of the Orbit that contains the Eye. (L)

A *Sinus* is a Cavity, whose Orifice, or Entrance is very

very narrow and the Bottom large. These Sinus's are found in the *Basis* of the *Coronale*. (M)

There are, besides these, internal and external Cavities.

The internal are two, either great and apparent, as are those of the great Bones, which contains the Marrow; or little and porous Cavities, as those in the *Vertebrae*, and *Epiphyses*; which contains only a Medullary Juice.

The External are of three Sorts, either great Cavities incircled with thick Brims, and are called *Cotyloæ* or *Cotyloides*, (N) from the Name of an old Measure among the Antients; such is that of the *Os Ischium*, that receives the Head of the *Femur*; or moderate and less deep Cavities, called *Glenoides*; (O) such as that of the *Scapula*, which receives the Head of the *Humerus*; or else little and flat, (P) as those at the Ends of the Bones of the first Rank of the Fingers, which receives the Heads of the Bones of the *Metacarpus*.

These Cavities are simple (Q) or double; the first Sort receive only one Head, as that at the End of the *Radius*; and the double (R) ones receive two, as that which receives the End of the *Tibia* from above; and those of the Bones of the two last Ranks of the Toes. They are also of a different Figure, some are like a Pulley, as those of the lower Extremity of the *Humerus*, which receive the *Os Cubiti*; others like a Half Moon, as those of the upper Part of the *Cubitus*.

All these external Cavities which serve for Articulation, have every one of them an Eminence on their Circumference, to which is tied a circular Ligament, which inclosing the Head of the Bone they receive, serve to strengthen the Articulation, and prevent *Luxation*, which would often happen, if such Ligament was not there.

The same Bones are not always of the same Bigness in all Bodies, not even in Persons of the same Stature or Height; for it happens that among them, some have their Bones smaller than others, and consequently are better shaped.

The Difference of Age, make also a very great Difference in the Magnitude of the Bones; for they grow and magnify from the Birth to the twentieth Year, or thereabout; from twenty to threescore, continue of the same Bigness; and after threescore begin to decrease, because, at that Age, the bony Fibres grow dry, and waste, and come closer together.

Bones are likewise different in their Colour; for some are white, others less white, and others of a greyish Colour; which proceeds from the different *Habit*, or Constitution of the Bones, and not from the first Matter they are formed of, as supposed by Mr. *Dionis*.

The Bones are nourished, like the other Parts of the Body, by the Blood, and not by the Marrow, which only serve to cement them; for there is a vast Number of *Ductus* in the Body of Bones, through which the Nourishment is conveyed, by Means of the Arteries, and the remaining Superfluity returning thro' the Extremities of these *Ductus*, is received by the little Veins which carry it back into the Mass of the Blood.

There is no Sensation in the Bones, but they are covered with the *Periosteum*, which is a very small and very sensible Membrane.

There are 249 Bones in the whole human Body, viz. Sixty in the Head; sixty-seven in the Trunk; in the Arms and Hands sixty-two; and Sixty in the Thighs and Legs.

Of sixty Bones in the Head, there are Fourteen of them in the *Cranium*; and forty-six in the Face, reckoning among them the *Os Hyoides*; the fourteen belonging to the *Cranium*, are the *Os Coronale*, the *Os Occipitis*, the two *Bregma's* or *Parietalia*, the two Temporal, the *Os Ethmoides*, the *Sphenoides*, and the six auditory Bones, or the *Iacus*, *Stapus*, and *Malleus* on each Side. Of forty-six that are in the

Face; there are seven and twenty of them in the upper Mandible; the Cheek Bone, the Nail Bone; the Maxillary or Jaw Bone, the Bone of the Nose, and that of the Palate, and the same Number on the other Side; the Eleventh, which is single having no Fellow, is in *French* called *La Pointe*, being like the Coulter, or Share of a Plow; there are sixteen upper Teeth, eighteen in the lower Mandible, to wit, two Bones and sixteen Teeth, to which being added the *Os Hyoides*, will compleat the whole Number of sixty Bones in the Head.

Of sixty-seven in the Trunk of the Body; there are thirty-two of them in the Spine, and twenty-nine in the Breast. Those of the Spine are seven in the Neck, twelve in the Back, five in the Loins, five in the *Os Sacrum*, and three in the *Cocciæ* or Rump Bone. Those of the Back are the four and twenty Ribs, the two *Claviculæ*, and three in the *Sternum*. There are likewise six *Offa Innominata*, which are the two *Iliæ*, the two *Ischia*, and the two *Offa Pubis*.

Of sixty-two, in the upper Limbs, each Arm and Hand has one and thirty, which are the Shoulder-blade, the *Humerus*, the *Cubitus*, the *Radius*, eight in the Wrist, four in the *Metacarpus*, and Fifteen in the Fingers; the same Number in the other Arm.

Of sixty in the lower Limbs, there are thirty in each, as the *Femur*, the *Rotula*, the *Tibia*, the *Fibula*, seven in the *Tarsus*, five in the *Metatarsus*, and fourteen in the Toes. The same on the other Side.

We could increase the Number of the Bones, if we would make several of the *Os Hyoides*, or add to them the *Sesamoïdes*; or decrease it, if we were to reckon the two Bones of the lower Mandible to be but one; and make but one Bone of the *Os Sacrum*, instead of five; but as it is better to keep to some determinate Number, that of 249, being the most universally received among the best Authors, I judge proper to stick to it.

Next to the Bones, the *Cartilages* are, of all the Parts of the Body, the hardest, and almost of the same Nature with the Bones, from which they differ, only, in more or less. They are of three Sorts, some are hard, and become quite bony with Time, as those which enter into the Composition of the *Sternum*, and those that tie the Appendages to the principal Bone: Others are softer and contribute to the Composition of the Parts, as the Cartilages of the Nose, the Ears; the *Xiphoides*, and that of the *Cocciæ*; and some are of the Nature of Ligaments, very soft, and therefore, are called Ligamentary Cartilages.

They are also different in their Figure, and are called by the Name of those Things they resemble most; *Annular*, if like a Ring; *Xiphoides*, or *Ensisformis*, if in the Shape of a Sword, &c. They commonly associate themselves with the Bones, yet there are some that do not touch together, as those of the *Larynx*, and the Eye-lids.

As the *Cartilages* receive neither Membranes nor Nerves into their Composition, they have no Sensation, neither have they any Cavities, and instead of Marrow, they have a viscous and flexible Substance that preserves them.

The Uses of the *Cartilages*, are to hinder the Bones from hurting one another by a mutual Collision; to join them together in divers Places by Syncondrosis, and to contribute much to the better Shape of many Parts, as do those of the Nose, the Ears, the *Trachea*, the Eye-lids, and some others.

A *Ligament* is of a solid and white Substance, it is softer than the Gristle, and harder than a Nerve or Membrane. It has neither Cavity nor Sense, nor Motion. Some of them are strong, being placed within between the Bones; some thick and round, called Cartilaginous Ligaments; and some thin, and of a membranous Nature, which cover the Bones outwardly. They are of divers Figures; some large, called Membranous, and others round or nervous; not that they are in reality Membrane or Nerve, but for the Resemblance they have to those Parts.

The only Use of the Ligaments, is to tie, like a Cord, the Parts of the Body, and chiefly the Bones, which they keep joined and united together, and hinder them from being displaced by the frequent Motions of the Body.

Thus far of the Bones in general; but to enter into a more particular Description of them, I divide a *Skeleton* into three Parts, viz. the Head, the Trunk, and the Limbs; and begin with the Head as the most apparent and the noblest Part of the Body.

Hippocrates defines the HEAD a bony Part consisting of two Tables woven together with the *Diploe* between them, and covered outwardly with the *Pericranium*; and lined inwardly with the *Dura Mater*.

The Substance of the Head differeth both from the *Thorax*, and the *Abdomen*, by its being altogether Bony, whereas the *Abdomen* is wholly fleshy, and the *Thorax* partly fleshy, and partly bony.

The HEAD is divided into two Parts, of which one is covered with Hairs called the Cranium; Skull, or Scalp; and the other without Hairs called the Face.

The CRANIUM comprehends the Bones which contain the Brains and the *Cerebellum*. It is divided into two Tables which are like two *Lamina*, laid one upon the other; between which there is the *Diploe* or a medullary Substance, full of little Cells of a different Bigness, that receive their little Arteries from the Brain, and transmit the little Veins into the Sinus of the *Dura Mater*. It is between these two Tables that the Blood is lodged which nourishes the Cranium; and it is this same Blood which is seen to drop forth in the Operation of the *Trepan*, when the first Table is bored through.

The exterior and superior Superficies of the Cranium is smooth and polished; but the inferior is very rough and unequal, by reason of the many Processes and Appendages found in it. Likewise its internal and superior Superficies is smooth, some little Channels excepted, made in it by the Vessels that creep upon the *Dura Mater*, when the Cranium is still moist and cartilaginous; but it has its internal and inferior Superficies unequal, by reason of its Productions and Cavities.

The Cranium has many Holes of a different Bigness, which gave Passage to the *Medulla Spinalis*, and to the Nerves, Arteries, and Veins, which fill up those Holes so exactly, that neither Vapours nor Fumes can come into them nor go through them, but by Means of the Vessels themselves.

The Cranium is composed of a great many Bones, distinguished by the Junctures called Sutures.

Those Sutures are either proper or common; and the proper are divided into true and false Sutures. The true Sutures are those indented together like the Teeth of a Saw. The Cranium has three of that Sort, the Coronal, the Lamboide, and the Sagittal.

The Coronal is placed on the Fore-part of the Head, and extending from one Temple to the other, joins the *Os Frontis*, with the two Bones of the *Sinciput*; that Suture is called Coronal, from its circular Figure. (A)

The Lamboide is opposite to the Coronal, and unites the *Os Occipitis*, with the two Bones of the *Sinciput* behind, 'tis called Lamboide from its being like a Greek Λ . (B)

The Sagittal, from the Latin *Sagitta* an Arrow, because this Suture is strait like it, is placed in the superior Part of the Head, it goes from the Coronal to the Lamboide, and joins the two Bones of the *Sinciput* in their uppermost Part. The Sagittal sometimes descends to the Root of the Nose, and then it divides the *Os Frontis* in two Parts, and in some Bodies, the *Os Occipitis*. These three Sutures are sometimes so strongly united in old People, that they seem to be but one entire Piece. (C)

The false Sutures are those that are joined like the Scales of Fish, for that Reason called *Squammose*, Scaly; they are two in Number, one on each Side; and joining the superior and smaller Parts of the *Os*

Petrosum, with the *Parietalia*, or Bones of the *Sinciput*. (D)

The Sutures that separate the Bones of the Cranium from those of the Face are called Common, there are four of them, the Transversal, Ethmoidal, Sphenoidal and Zigomatick.

The Transversal, so called, because it transverses the Face from one Side to the other; begin at one of the small Angles of the Eye, and passing by the Bottom of its Orbit, by the Root of the Nose, finishes its Course at the other little Angle.

The Ethmoidal incircle the *Os Ethmoides*, and separate it from the neighbouring Bones. (E)

The Sphenoidal incompasses the *Os Sphenoides*, and separate it from the *Os Coronale*, the *Os Petrosum* and the *Os Occipitis*. (F)

The Zigomatick is placed wholly in the Zigoma, from whence it derives its Name. It is a very small Suture, and separates the *Os Petrosum* by its Process from the Cheek-bones. These Sutures are not so apparent as the former, and we must observe them very near to see the little Pieces of Bones that fall into their intermediate Spaces. (G)

These Sutures are of three principal Uses, 1. They are for the Adhæsion of the Ligaments, which tie the *Dura Mater*. 2. They give Passage to the Vessels which go in and come out of the *Diploe*; and 3. They help the Perspiration, since those who have the Sutures of the Cranium too much closed are subject to intolerable Pains of the Head, because the Perspiration is thereby hindered.

The Bones of the Cranium are either Proper or Common. The Proper are six, the *Os Coronale*, *Occipitis*, the two Bones of the *Sinciput*, and the two Parietal Bones. The Common two. The *Os Sphenoides* and *Ethmoides*.

The Coronale or *Os Frontis*, is the hardest of all the Bones of the Head next to that of the *Occiput*; it is smooth outwardly, and rugged inwardly; its Situation is in the uppermost Part of the Face, and the foremost of the Cranium, whence it makes the Front or Forehead, and is therefore called *Os Frontis*. This Bone is bounded above by the Coronal Suture, and below by the Transversal. By the first 'tis joined with the Bones of the *Sinciput*, and by the second to those of the Nose and Cheek, as well as to the *Sphenoides* by the Sphenoidal Suture.

The Parts of this Bone are either solid or hollow; the solid are the four Processes, whereof there are two at the great Angles of the Eye, and two at the small Angles, which form the Cavity of the Orbits. The hollow Parts are of three Sorts, Holes, Pits, and Sinus. The Holes are three in Number, two external placed at the Eye-brows; a Branch of the fifth Pair of Nerves passes through them, and is distributed into the two frontal Muscles, and to the proper Elevator of the upper Eye-lid. The third Hole is internal, and situated above the *Christa Galli*; in this Hole adheres the Root of the right Sinus of the *Dura Mater*, which makes a small Fold that sinks into it in shutting it.

The *Os Coronale* has four Pits, two externals, which form the superior Part of each Orbit; and two internal, for the anterior Cavities of the Cranium, and serve to lodge a great Portion of the Brain, with the two mamillary Processes.

There are two Sinus's of the *Os Coronale*, called the Sinus of the Eye-brows, because they are situated at the lower Part of that Bone, near the Eye-brows. Those Sinus are formed by the Elongation of the two Tables of the *Os Coronale*, whereof the external Table advances outwardly, to form the superior Eyebrow of the Orbit, and the internal Table retires inwardly, to make the Roundness of the anterior Cavity of the Cranium; and therefore I am of Opinion, that the Use of those Sinus is to hinder an Angle, which otherwise would be formed in the mechanical Structure of the *Os Coronale*, and very much incommode the Brain; though I would not deprive those Sinus of some others of the Uses attributed to them;

them; since I really believe with some Authors, that they are, besides, like two Sources, that furnish Abundance of moist Humour to the Nose: But I reject all other Uses, as merely imaginary and fictitious.

The *Os Occipitis*, which is the second Bone of the *Cranium*, is opposite to the *Coronale*. This Bone is the hardest of all the Skull; it is of an oblong Figure, having five Sides, or two circular Lines, that terminate in a Point: It makes the whole hinder Part of the Head, where it is placed; bounded by the *Lambdoide*, and *Sphænoïdal* Suture; the one joins it with the Bones of the *Sinciput*, and the other with the *Os Sphænoides*.

The Parts of this Bone are either solid or hollow; the solid are two Processes received into the *glenoide* Cavities of the first *Vertebra*, and join the Head with the Spine, by *Synarthrosis*. The hollow Parts are either Holes or Pits.

The Holes are either common or proper. There are two common, one on each Side of the *Os Petrosus*, which give Passage to the *Nervi vagi*, and to the internal Jugular Veins. The Proper are five, the first is single, and very great, through which the *Medulla Spinalis* passes, and the vertebral Arteries, which slip into a little Notch that is behind the *Condylus* of the *Os Occipitis*, as they pierce the *Dura Mater*. Two others give Passage to the ninth Pair of Nerves, which distribute themselves wholly in the Tongue. The two last let the vertebral Veins come forth.

The *Os Occipitis* hath four Pits, two lower ones, which are the greatest, and serve to lodge the *Cerebellum*; and two Superiors that are smaller, and contains the posterior Lobes of the Brain, separated from the *Cerebellum*, by a transversal Inclosure, formed by the *Dura Mater*, in order to hinder the *Cerebellum* from suffering Compression.

The third and fourth Bones of the *Cranium*, are those of the *Sinciput* (M M) and called *Offa Parietalia*, from their being a Kind of Wall to the Head, the Sides whereof they possess entirely; they surpass in Magnitude all the other Bones of the Head; they are of a square Figure, joined together in their superior Part, by the sagittal Suture; in their anterior Part to the *Os Frontis*, by the Coronal to the *Os Occipitis*; in their posterior Part, by the *Lambdoide*, and to the *Os Petrosus*, in their inferior, by the squamous Suture. These Bones have their external Surface very smooth; but their internal is unequal, by Reason of the Impressions that represent the upper Side of a Fig-leaf, and which have been made by a Branch of the external *Carotide*, which makes a Kind of Wrought-work on the *Dura Mater*, that covers all which lies under these Bones.

They have each a little Hole near the sagittal Suture, through which pass the Branches of the external Jugular, to receive the superfluous Blood, that could not be used in nourishing the Teguments, and to dispose it into the longitudinal *Sinus* of the *Dura Mater*.

The fifth and the last Bones of the *Cranium*, are those of the Temples, (N N) divided, by the *Anatomists*, into a superior Part, which is semicircular; and an inferior which resembles a Rock. They are placed on the Side, and the lower Part of the Head, and circumscribed upward by a Suture, called false Suture, and thereby united to the Bones of the *Sinciput*; behind, to the *Os Occipitis*, by the *Lambdoide* Suture; and forward and below, with the *Os Sphænoides*, by the *Sphænoïdal*.

The Parts of these Bones are prominent or hollow. The protuberant Parts of the *Os Petrosus*, are their internal or external Processes; the internal are two, one on each Side like a great Rock, in which are the auditory Cavities, and the four little Bones that belong to it. The external Processes are three, the *Mastoides*, the *Apophysis Stiloïdes*, and the *Zigomatick* Processes, which by advancing outwardly, and joining to the Eminence of the *Os Malum*, form the *Zigoma*.

The Bone of the Temples hath five Holes, four externals and one internal: This last is internal, and

called the internal Auditory Hole. The first of the external Holes, is the external Auditory, otherwise the Conduct of Hearing. The second is called the oblique Hole, it is large and of an oval Figure, it opens obliquely into the Canal or bony *Sinus*. The third is a little Hole found at the Bottom of two Processes, between the Apophyses, *Mastoides*, and the *Styloïdes*, through which comes forth the hard Part of the Auditory Nerve; and the fourth of the external Holes, is the Canal of Communication, which opens to the Barrel of the *Tympanum*.

The Pits are likewise internal and external; the internal are two, and make the middle Cavities of the *Basis* of the Brain. The External which are two, also serve for the Articulation of the lower Mandible. The *Sinus* are two, there is one in each of the *Apophyses Mastoides*.

In this Rock which forms the *Os Petrosus*, there are four little Bones, the *Malleus*, (O) *Incus*, (P) *Stapes*, (Q) and the *Os Orbiculare*, which are thought as hard and as big at first as ever they will be during the whole Life; nevertheless they grow stronger with Age, and are really harder at the End than they were at their first Formation, though all of a Cartilaginous Nature.

In this Rock there are three Cavities, the *Drum*, the *Labyrinth*, and the *Shell*. In the first of these Cavities are placed those four little Bones which are articulated together, so that the Process of the *Malleus* is tied to the *Tympanum*, and articulated by its Head in the Cavity of the *Incus*. The *Incus* or Anvil hath two Legs, whereof the shortest is placed on the *Tympanum*, and the longest on the *Stapes* or Stirrop. The *Stapes*, whose two Branches are placed on a large *Basis*, receive the little Tubercle of the *Incus* by its sharp and exterior Part. In Infants is found a Bone called *Orbiculare*, (R) It is circular like a Ring, on which the *Tympanum* or Drum is stretched, as the Skin of a Drum is stretched on a Barrel. This Bone was first discovered by *Silvius de la Bœe*, and is tied by a small Ligament to the lateral and superior Part of the *Stapes*.

The *Os Sphænoides* (S) is the first of the two Bones that are common to the Scalp and the Face. It is thick in its *Basis*, and very thin in the Cavity of the Temples; it is sufficiently large and hard, and accounted but one Bone, although in Infants it may be divided into four. It is of such an Extent that it touches all the Bones of the Head, and many of the upper Mandible, with which 'tis united by a Part of its Suture. The *Sphænoides* hath, like the other Bones of the Head, its Holes, Pits and *Sinus*.

It hath six Holes. The *Optick* through which the optick Nerve passes. The great Cleft in the *Orbit* through which the nervous Branches of the 3d, 4th, 5th and 6th pass, together with the Blood-branches of the *Carotide* and Jugular. Its third Hole is under the aforesaid Cleft; it is round, and gives Passage to some of the Branches of the fifth Pair of Nerves, but they are its inferior Branches. The fourth is a bony Channel dug into the *Os Petrosus*, which goes obliquely to the Saddle of the *Os Sphænoides*. In this Channel or bony *Sinus* the internal *Carotide* lie, which rises thence towards the Saddle. The fifth Hole is the oval Cleft, that lets the great Branch of the fifth Pair of Nerves, which is the Posterior Branch, come forth. The sixth Hole is a little round one, through which passes a Branch of the external *Carotide*, that make the Resemblance of a Fig-leaf on the *Dura Mater*, under the Bone of the *Sinciput*.

Its Pits are three in Number, one internal on the Saddle of the *Os Sphænoides*, and which serve as a *Basis* for the *Glandula Pituitaria*; and two external placed in the *Apophyses Pterygoïdes*.

In the Middle of the *Os Sphænoides*, under the Saddle, are found two *Sinus's* separated by a bony *Lamina*, which open in the Nose. These two *Sinus's* are invested with a Membrane altogether glandulous, and always covered with a *Mucus*, because the little Glands of this Membrane separate from the Blood a *Serum*, which

which acquires Consistence by its Continuance in the *Sinus*, and when they are full of it, this *Mucus* is thrown out at the Apertures into the Hole, by mixing with the Snivel it there meets.

The *Ethmoides* (T) is the last of the Bones that are common to the Scalp and Face. It is the smallest of all the Bones that compose the *Cranium*, and is joined to the *Os Coronale* in its upper Part by a common Suture called Ethmoidal; and by the Sphœnoidal to the *Sphœnoides*. It is divided into three Parts; the Upper or Sieve-like Part, which hath Abundance of little Holes; the Lower which is spongy, and separates the Cavity of the Nostriils in two; and into lateral Parts which are full and flat, and make Part of the *Orbit*.

This Bone hath a Prominence called *Crista Galli*, because it resembles the Comb of a Cock, it is very hard, and Part of the *Dura Mater* is tied to this Place called *Falx*, which Falx or Scythe divides the Brain into two Parts.

From the Bones of the Head we proceed to those of the Face.

The Face consists of two Mandibles or Jaws, *viz.* the Upper Jaw which comprehends all from the Eye to the Bottom of the upper Lip; and the Lower Jaw which extends from the Top of the under Lip to the End of the Chin.

The upper Jaw hath no Motion, the lower, on the contrary, is moveable, since Mastication is its Office.

There are eleven Bones in the upper Jaw, five on each Side, and one in the Middle, *viz.* the Bone of the Nose, the *Os Unguis*, the *Pomette*, the Jaw-bone, the Bone of the Palate or Roof of the Mouth, and the Share-bone. These Bones are separated from the *Cranium* by common Sutures, and joined together by *Harmonia*, which is the Cause that they have no Motion.

The Bones of the Nose, (A) though they be very thin, are of a solid Substance; they are very small, and of a Piramidal Figure; they are placed on the upper Part of the Nose, and compose what is called its Bridge. These Bones are terminated above by the transversal Suture, whereby they are joined with the *Os Frontis*, and on the Sides by two *Harmonia's*, that is, one of those Sutures joins them together, and is in the Middle of the Nose; and the other unites them with the two Jaw-bones. These Bones are smoother in their outward Surface than they are in the inward, and their lower Part is unequal and in Slits, that the Cartilages may the better stick to them.

The French call *Os Unguis* (B) two Bones of the Bigness and Figure of a Nail, placed at the great Corner of the Eye; they are of a thin Substance like a Scale, and the smallest Bones of the upper Jaw. These Bones touch four other Bones, the *Os Frontis*, the Bone of the Nose, the Jaw-bone, and that Part of the *Os Ethmoides* which forms the Orbit of the Eye, though they hold fast to neither of those Bones, and are seldom found in a Skeleton, for they are easily lost in the boiling.

The Bones of the Cheeks, which are the fifth and sixth Bones, are very large, and of a hard and solid Substance; their Figure is triangular, their middle Part is a little prominent outwards, and round like an Apple. These Bones compose the Cheek and the lower Part of the *Orbit*; and are fastened to the *Os Frontis*, the *Sphœnoides*, the Jaw-bone, and the *Os Petrosum*. Each of them hath three Processes, one forms an Eminence, which, rising upwards, makes the little Corner of the Eye; another advancing toward the Nose, makes the greatest Part of the lower Eyebrow of the *Orbit*, and the third joining with a Prominence of the *Os Petrosum*, helps towards the Formation of the *Zygoma*.

The Jaw Bones (D) are the greatest of all the Bones of the Face, and the most spongy. They make some Part of the Cheek, contribute to the Formation of the inferior Part of the Orbit; compose the greatest Part of the Palate, and articulate all the upper Teeth. They are situated on the Side,

and under the Bones of the *Os Male*, possessing the inferior Part of the upper Jaw; and they touch the Bones of the Nose, the Palate, the *Os Male*, and those of the Orbita.

These Bones have also their Holes, Pits, and *Sinus*. Their Holes are internal and external; of the Internal, which are four in Number, two are called Incisives, because directly under the Teeth *Incisores*; and the two others are placed on the lateral and posterior Parts: The two external ones are called Holes of the Orbit, the Nerves of the fifth Pair pass thro' them, and are distributed into the Face. There are sixteen Pits in each Jaw, which are the *Alveoli*, in which sixteen Teeth are fastened; and two *Sinus* in each, situated along the Extremities of the Roots of the Teeth.

The two Bones of the Palate, (E) which are the ninth and tenth Bones of the upper Jaw, are situated at the Bottom of the Palate, and make the deepest Part of the Roof of the Mouth; they are joined together by the Suture of the Palate, which advancing forward near the *Dentes incisores*, unite also the two Jaw-bones: They are likewise fastened to the *Apophyses*, *Pterigoides*, by the sphœnoidal Suture. Each of them hath a Hole called *Foramen Gustavium*, through which passes a Branch of the fifth Pair of the Nerves: These Bones are very hard, but so small that they make but the least Part of the Palate; they are almost square, being a little bigger than they are long.

The Bone which divides the Nostriils into two, is called the *Plough-bone* (F) from its Resemblance to the Coulter of the Plough; it is the eleventh Bone of the upper Jaw, is placed in the Middle, above the Palate, is hard and small, is a single Bone, and is joined with the *Os Ethmoides* and *Sphœnoides*, which have both some small Eminences that are received in the Cavities of the Plough-bone, and which thereby strengthen it in its Position.

The ORBITS (GG) of the Eye, situated at the lower Part of the Forehead, appointed for a Mansion to the Eyes, and to defend them against all that may offer to hurt them; are of a piramidal Figure, and composed of six different Bones, which, altogether, form their Extent and Depth. Of these Bones there is one proper to the *Orbit*, which is the Orbitary-bone, situated in the great Corner of the Eye; and five common, as the *Os Frontis*, which forms the superior Part of the *Orbit*, and serves for an Arch to it; the *Ethmoides*, which makes the lateral Part of it, towards the Nose; and the *Sphœnoides*, which form the most inward Part of it; these three Bones belong to the *Cranium*. The Bone *de la Pomette*, makes that Part which is near the little Corner of the Eye; and the Jaw-bone, that which is next the great Corner.

The ZYGOMA (HH) is a Union or Coalition of two Prominences of Bones, whereof one comes from the Temporal-bone, and the other from the Cheek-bone: These Prominences are joined by a small oblique Suture; these two Bones form an Arcade, which hath two very considerable Uses; one is to give Passage to the Muscle *Crotaphytes*, and to serve for a Defence to it; and the other is to give Rise to the Muscle *Masseter*, whose Office is, with the *Crotaphytes*, to help the Mastication.

The lower Jaw (II) consists of two Bones until the seventh Year of Age, after which they turn into one, joining together in their anterior and middle Part by *Symphysis* without a Medium. They serve for *Basis* to sixteen Teeth articulated into them; their Substance is very hard, that they may be strong enough to bite and chew.

The TEETH (L) are defined by Anatomists, small hard Bones, white and smooth, articulated in the Jaws by *Gomphosis*.

They differ from other Bones in that they have no *Periosteum*, and therefore have no Sense of Pain, but only at their Root where the Nerve enters.

Although the Teeth exceed all the Bones of the Body

Body in Point of Hardness, they nevertheless consume by their continual Action and Friction against one another; for which, cautious Nature has given them Vessels to convey them a Matter, to nourish and repair them.

The Time is not certainly fixed by Nature for the Expulsion of the Teeth; some Infants have had some Teeth from their Birth, (as the late King of France, Lewis XIV, which is rather to be attributed to a Caprice of Nature, than to any other Cause, from whence a superstitious Rabble is but too prone to draw false Inferences) others in the first Month; others in seven or eight, which is the most usual Time; and some not till they are a Year or two old.

The Teeth don't come forth all at a Time, because then, the Infants would not be able to overcome, without the most imminent Danger, the Convulsions they are subject to at the Time of their toothing; which to avoid, Nature expells them one or two at a Time; though it sometimes happens that they have three or four coming together, which is always to be feared, as a very dangerous Case.

The Infants have commonly twenty Teeth in twenty Months, which is all they ought to have at that Age, (the rest not coming forth for some Years after) and which is the properest Time to wean an Infant, and not before; because the Milk is not only the best Nourishment for breeding the Teeth, but also for keeping the Gums moist, especially when the latter Teeth are bred; because they having their Ends thicker, they break forth of the Gums harder than the first.

The twenty first Teeth are called the Milk-teeth; they commonly fall, toward the sixth or seventh Year, because they are double from their first Conformation; and because those under the *Alveoli*, push forward the former toward that Time. It is good to help out those Milk-teeth, so soon as they begin to loosen, that those which come underneath, and are to continue for Life, may rise strait, and in a good Position.

The twenty first Teeth being cut, the Child remains in that Condition unto the seventh Year of his Age; and then four more appear behind the former: At fourteen there comes four more; and four more at twenty; which put together, make up the whole Number of thirty-two.

All the Teeth are ranged in Order, one by another, although sometimes there will happen a double Row of them, which is a vicious Conformation, because it is both a Deformity, and inconvenient.

Every Tooth hath its Cavity in the Middle, where the Nerve is inserted. In that Cavity a certain Acrimony is sometimes found, which corrodes and spoils the Tooth; and not Worms, as vulgarly supposed.

The Teeth have three different Uses; the first and chiefest is for Mastication; the second, to distinguish the Voice; and the third for Ornament.

The Teeth are divided into *Incisores*, Dog-teeth and Grinders. The *INCISORES*, (MM) so called, because they cut the Meat like a Knife, are eight, four in each Jaw, placed before the rest outwardly, and in the Middle of the others. Their outward Surface is like an Arch; and the anterior is hollow; they are sharper and shorter than the rest; and each hath but one single Root which terminate in a Point.

There are four Dog-TEETH, (N) two in each Jaw; they are called Dog-teeth, because they break the hardest Bodies. Their Situation is next to the *Incisores*, one on each Side; they are thick, strong, and solid, fastened in their *Alveoli*, by single Roots, like the *Incisores*, but deeper; for they exceed all the rest in Length. The upper Dog-teeth are called Eye-teeth, because Part of the Nerve which moves the Eye is ramified, or branched toward them.

There are twenty Grinders, (OO) ten in each Jaw, and five on each Side; they are large and hard, and encrease in Bulk, according to their deeper Situation in the Mouth; they have divers Roots, which serve the better to fasten them in their *Alveoli*: The

lower Grinders have but two or three Roots, and the upper ones three or four; because those upper ones being in a hanging Position above, have Occasion of a greater Quantity to keep them fixed and firm.

The *Os Hyoides*, (P) the last of the sixty Bones of the Head, is placed at the *Basis* of the Tongue, upon the *Larynx*, and kept in its Place by ten Muscles: It touches no other Bone, but is tied above by Bones, called its superior *Cornua*, to the two *Apophyses Styloides* of the Bone of the Temples, by small Ligaments; and below, at its inferior *Cornua*, it is joined unto the two Wings of the *Cartilage Thyroides* of the *Larynx*, by Ligaments of the same Nature with those that tied its upper Part, which is a true *Syneurosis*. This Bone is composed of five others, the greatest of which makes the *Basis*. This *Basis* is arched outwardly, and hollow within; two other lesser Bones are united to this, one on each Side; and two very small ones, are joined at the End of these last; which four Bones, make the Sides of the *Os Hyoides*, and what we call the *Cornua*. (QQ)

The principal Use of this Bone, is to facilitate the Admittance of Air into the *Aspera Arteria*, and the Passage of Meat and Drink into the *Œsophagus*, by keeping the *Pharynx* in that just Bigness it ought to have, for the free Passage of the Nourishment.

From the Bones of the *Cranium*, I descend gradually to those of the *Spine*.

The *SPINE*, is a Complex of many Bones articulated together, to serve for Habitation and Rampire to the Marrow. It is divided into five Parts, the Neck, the Back, the Loins, the *Os Sacrum*, and the *Coccyx*. If the *Spine* be considered before, or behind, it appears direct and strait; but if on either Side, it falls inward, or outward, both for its better Support, and to remove from, or to approach to the Part of the *Thorax*, and the *Abdomen*.

The sharp End of the *Spine*, at the Neck, bends inwards, the better to sustain the Head which is there placed, as on a *Pivot*.

The *Spine* (R) serves to support the Body, for the Insertion of several Muscles, and for the Conveyance of the Marrow. The Parts it is composed of are called *Vertebræ*, from *Verto* to turn, because the Body turns several Ways by their Means.

Each of the *Vertebræ* hath its Body in its internal Part, wherewith they support one another; they have all a great *Foramen*, through which the *Medulla Spinalis* passes; all three Sorts of Processes, four oblique, two transverse, and one acute; and all five *Epiphyses*, or Appendages, viz. two at their Body, two at the Extremities of their transverse Processes, and one at the End of their acute Process. They are likewise all pierced through on their Sides, for the Passage of the Nerves that come through them; i. e. that two *Vertebræ* make a Hole between them, but one Half of the Hole appearing in each of them, the other Half being hidden in the Cartilage, which ties two *Vertebræ* together; if they are not perforated in their middle Part, 'tis because such Perforation would weaken them too much.

There are seven *VERTEBRÆ* in the Neck (B) more solid and harder than those of the Back, (because their Office is to support the Head, which is a very weighty Part) though they are smaller, for were they as big as those of the Back and Loins, the Neck had not been able to move so easily as it does.

The first of these seven *Vertebræ* is called *ATLAS*, (C) because it supports the Head, which being of a round Figure resembles the World, which the ancient Poets have feigned to be borne by Mount *Atlas*. This *Vertebra* hath no acute Process, because the Head don't move upon it, but upon the second; and because it being obliged to turn as often as the Head has a circular Motion, an acute Process would have discommoded the Posterior Muscles of the Head, especially the two little right Muscles which rise from the second *Vertebra*, and are inserted in the *Occiput*.

This differs from the other *Vertebra*, in that it is of a more delicate, thinner, and harder Substance, and

and that it receives at both its Extremities while the others receive on one Side, and are received on the other; for two Prominences of the *Occiput* enter into its two superior Cavities, whereby it is articulated with the Head; and, at the same Time, two other Prominences of the second *Vertebra* enter its two inferior Cavities which join them both.

The Articulation of the Head is made on the anterior Part of this *Vertebra*, not on its posterior, that it may be the better supported, and the better kept in its *Æquilibrium*. This *Atlas* giving Passage to the *Medulla Spinalis* as all the other *Vertebrae* do, and receiving besides the Tooth of the second, which passing thro' it, unites itself to the *Os Occipitis*; its Aperture must be greater than that of the rest.

The Head and the first *Vertebra* turning upon the second as on a Pivot, it is called for that Reason the wheeling *Vertebra*, (D) and from the Process, which rises from the Middle of its Body, in the Form of a Tooth, *Dentata*. This Process would expose the *Medulla Spinalis* to some dangerous Compression, was not the second *Vertebra* environed with a strong, solid and curious Ligament; other particular Ligaments join it with the first *Vertebra*, and tie them both strongly to the Head.

The third *Vertebra* is called the *Axis*, (E) because it begins to form a Body, on which the two former *Vertebrae* and the Head are supported, as on an Axle-Tree; the four following have no particular Name. There is only this to be observed, that the last hath no acute Process forked like the others, and that it begins to assume the Figure of the *Back*, (F) which is composed of twelve *Vertebrae*, larger than those of the Neck, and smaller than those of the Loins; tho' they are not at all equal, becoming larger and stronger in Proportion as they descend lower. They are all of a Pyramidal Figure; have their Processes spiney, simple, and acute, which rest upon one another; their transverse Processes very large, for the Articulation of the Ribs fastened to them; for each *Vertebra* of the Back articulates two Ribs, both by its Body and its transverse Processes.

The first of these *Vertebrae* (G) being higher than the rest, is called *Eminent*; the second *Axillary*, from its being nearest to the Arm-pit. The eight following, articulating those Ribs inwardly invested with the *Pleura*, are called both *Costal* and *Pleuretical*. The Eleventh (H) is called the *Direct*, because its acute Process don't bend downwards to rest upon the next below; and the Twelfth, *Girdler*, from its being situated in the Place where Girdles are worn.

The *Vertebrae* of the Loins, (I) because they support all the rest, are thicker and larger than those of the Back; have not their Articulations so close and compact, that they may be free in their Motions, and we able to stoop with more Ease; have their Processes longer and finer, which serve there instead of Ribs, the first and fifth of them excepted, which have them shorter. Those Processes are nine in Number, the ascending ones which articulate them together being double. Their Spines are also thicker and larger, the better to fasten to them the Muscles and Ligaments of the Back.

The Reins or Kidneys being placed on the Side of the first of these *Vertebrae*; or because, perhaps, it is in that Place that the Nephretick Pain begins to be felt, it is called Nephretick (L) or Renal. The three following next have no particular Name; and the fifth, which is the Prop and Support of the whole Spine, is called *Asparagitis*.

If the *Os Sacrum* (M) derives its Name from its being offered in Sacrifice to the Pagan Divinities, or from its Bigness, or from its enclosing the *Pudenda*, is what must be very indifferent to us. The Truth is, that the *Os Sacrum* is a great, large and immoveable Bone, which serves for a Basis to the Spine. Its Figure is triangular; its being hollow within serves to form the *Pelvis*, a Cavity situated in the lower Part of the *Hypogastrium*; and, for the better Insertion of the

Muscles, its posterior Part is convex and unequal. This Bone hath three different Articulations; the first with the last *Vertebra* of the Loin, like that of the other *Vertebrae*; the second by *Synchondrosis*, with the *Coccyx*, and the third with the *Ossa Innominata* by an indenting.

The *Os Sacrum* (N) is divided into five *Vertebrae* of a different Bigness, the superior thereof is the biggest, and which in Adults are so strongly united, that they make but one Bone, the better to support the whole Spine, and to articulate the *Ossa Innominata*.

The *Coccyx*, (P) so called, because it resembles the Beak of a Cuckow, is the last Extremity of the Spine, it is composed of three Bones, the greatest of which touch the *Os Sacrum*, the second is less than the former, and the third is very small, at the whole End is fastened a small Cartilage; they are all three joined together by a very loose Connexion, which makes them pliant, and to draw back easily behind. In Women they jet outward more than they do in Men, because they want a greater Cavity to inclose the *Matrix*, and to contain the Infant during their Pregnancy. The End of these Bones (Q) always bends inwards, that it may be no Inconvenience in Setting, but they draw backwards a little for the better Extrusion of the Excrements, as they do in Women at the Time of their Delivery, (R) to facilitate a Passage to the Infant.

From the *Coccyx* we come by a necessary Retrogradation to the THORAX, or Breast, from *ἡ στήθος*, *Salio*, is that Part of the human Body which forms the Capacity of the Breast; its Figure is oval, especially when the *Diaphragma* moves downwards, terminated above by the Clavicles, before by the *Sternum*, behind by the *Vertebrae* of the Back; on the Sides by four and twenty Ribs; and below by the Cartilages of the *Costae Nothae*, and the Cartilage *Xiphoides*.

The larger and deeper is the Cavity of the *Thorax*, the Parts contained therein move with greater Facility, and we are supposed to live longer. It is composed with the *Sternum*, the Ribs and the Clavicles.

The *STERNUM* (A) is all that anterior Part of the *Thorax*, which, above, touches the Clavicles, and ends below at the *Cartilago Xiphoides*, and laterally both on the Right and Left is joined to the Ends of the Ribs before. Its Body proceeds forward, but bends towards the Ribs, in order to form the round and oval Figure of the Breast, on which it appears as if couched.

In Adults it consists of one single Piece or Bone, but in Infants, of several, according to the Diversity of Age; if we believe *Kerkringius*, it never exceeds six, though Mr. *Dionis* pretends he has found eight in some Infants, which, by growing together, are reduced to four, and commonly to three.

The first of those three Bones (B) is the superior one, larger and thicker than the Rest, which hath a *Sinus* on each Side of its upper Part, which receives the Head of the Clavicle, with which it is joined by a Cartilage; and the other sinous Cavity found in the Middle of its internal and superior Part makes Room for the *Trachea*. The second (C) is placed under the former, is straiter and thinner, but longer, with divers *Sinus's* on both Sides, which receive the Cartilages of the Ribs that articulate in them. The third (D) is still less in length, but thicker; it is placed under the two former, and ends at the *Cartilago Xiphoides*.

This CARTILAGE, (E) so called, because it ends like the Point of a Sword, is commonly triangular and oblong; sometimes it is round, and sometimes divided in two: Whenever it sinks inwardly by some Stroke or Fall it occasions Vomiting, which ceases not until it is restored to its proper Place. This Cartilage serves to defend the Stomach, to tie and fasten the *Diaphragma*, and to support the Liver before by a large Ligament that's tied unto it. These three Bones are joined together by Cartilages, which serve

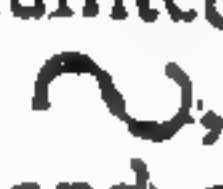
serve instead of Ligaments to them. They also form a Cavity which appears outwardly, and is called by the Vulgar the Pit of the Heart.

The *Sternum* forms the anterior and middle Part of the Breast, joins and articulates the *Costæ* and the *Clavicles*, contains and defends the Heart and the Parts for Respiration, and fastens all along its middle and internal Part to the *Mediastinum*, which is a Membrane which divides the Breast into two parts.

The *Costæ* or *Ribs* (FF) form the two Sides of the Breast. Their Substance is partly bony, and partly Cartilaginous, which Cartilages serve them instead of *Epiphyses*. Their Figure (F) is concave within to form the Capacity of the Breast, and Convex without to resist any Accident. The further they are distanced from the *Sternum*, they become narrower and round; flatten, and are larger the nearer they approach unto it. The superior *Ribs* are shorter than the middle ones, and the inferior very small, which Difference is necessary to form the Arch of the Breast. The *Ribs* are articulated at the Extremities of their anterior Part with the *Sternum*, by *Synchondrosis*, and by *Artbrodia* at their Posterior, with the *Vertebrae*.

There are four and twenty *Ribs*, twelve on each Side, and divided into true and false *Ribs*. The true *Ribs* are the seven superior, as the last five are the false ones; the true *Ribs* touch the *Sternum*, (H) with which they have a strong Articulation, and the false ones (K) don't touch the *Sternum*, and have but a very slack Articulation, though they are fasten'd to the *Vertebrae* behind; but, before, they terminate in long and soft Cartilages.

The Use of the *Ribs* is to form the Capacity of the Breast, to defend the Parts they inclose, and to give Origin and Insertion to several Muscles.

The two Bones which shut the superior Part of the *Thorax*, and fasten the *Sternum* to the Shoulders, are called *CLAVICLES*. (LL) There is one on each Side, and they both have a transverse Situation at the lower Part of the Neck, and upper Part of the Breast a little above the first Rib. Their Substance is thick, but porous and fungous; whence it is that they are often fractured, and when fractured, sooner reunited than any other Bone. Their Figure is like an , Convex outwardly towards the Neck, (N) and a little Concave inwardly, that the Vessels under them may not suffer Compression. The *Clavicles* help the different Motions of the Arms, which move easier backwards and forwards, because supported on these Bones, as upon a Basis; they are likewise of great Use to hinder the Arms from too great an Extension forwards.

The *HIP-BONES*, (NN) or *Os Innominata*, form the last Part of the Trunk of the Body. There are two *Hip-Bones*, one on each Side, articulated at their posterior Part by *Ginglymus* with the *Os Sacrum*; and at their lateral with the *Femur* by *Enarthrosis*.

These Bones have this common with all the other Bones, that, like them, they serve for the Insertion of the Muscles, and for Support to the whole Body; with this Difference, that they serve also to tie the inferior Extremities with the Trunk, to support the Spine, to help to form the Capacity of the *Abdomen*; and for a Basis to the Parts, and couch to the Parts contained in the *Hypogastrium*.

These Bones consist of three different Bones, which are the *Os Ilium*, *Ischium*, and *Os Pubis*, joined together by Cartilages, which remain such until about the tenth or twelfth Year of Age, but grow drier with Time, 'till they become so bony that they seem to make but one Bone with the others in adult Persons.

The *Os ILIUM*, (O) so called, because it contains the intestine, *Ilium*, being the greatest of the three, offers itself first; it is articulated with the *Os sacrum* by *Ginglymus*, strengthened by a Cartilage, and a very strong membranous Ligament.—Its Figure is Semicircular, having two Surfaces, the one internal, filled with one of the *Musculi Flexores Femoris*; and

the one external where the *Musculi Extensores Femoris* are inserted.

The *Costa* placed between these two Surfaces is bordered with two Lips, one whereof is likewise internal, and the other external. The two Extremities of this Rib end with two Prominences called Spines, of which the Superior is much greater than the Inferior. Near to this last, which is placed before, is seen an Indenting or Notching that facilitates the Passage of the Tendons of the *Musculi Iliaci*, and *Psoas*; of the crural Veins and Arteries, and of the spermatic Vessels.—With its inferior Part it forms a Part of the Cavities, which receives the Head of the *Os Femoris*.

This Bone is larger in Women than Men, for the Support of the Infant in the *Matrix*; and near this Bone Women with Child often feel a Pain, occasioned by the Weight of the Infant.

There are three Parts to be considered in the *Os ISCHIUM*. (P) Its superior, which makes the greatest Part of the *Cotyla*; its anterior which makes Part of the *Foramen Ovale*; and the inferior, in which two Processes are observed, the one posterior, called the Spine Process; and the other anterior, and inferior.—There is likewise seen a *Sinus* or Cleft, which gives Passage to the *Obturator Internus*.

This Bone is annexed to the *Os Sacrum* by a double Ligament that rises from it; one is inserted in the acute Process of the Hip; and the other behind at its Appendage, which supports the *Rectum Intestinum*.—Its Extremity, called the tuberos Part of the *Ischium*, gives Rise to the Muscles of the *Penis*, the *Levatores Ani*, and many of the *Flexores Femoris*.

The *Os PUBIS*, (Q) called also *Os Pectinis*, is situated at the middle and anterior Part of the Trunk. Its anterior Part is joined by Means of a Cartilage with its Fellow; its posterior forms one Part of the *Cotyla*. Between this Part and the Extremity of the *Os Ilium*, the *Sinus* is placed, through which the Tendons of the *Musculi Lumbares* and *Iliaci* pass. The Muscles of the *Abdomen* are inserted in the superior Part, otherwise called the Spine; and the inferior is joined with a Prominence made by the tuberos Part of the *Ischium*, both which Prominences make the *Foramen Ovale*; into which Prominences there are many Muscles inserted.—The *Musculi Obturatores Femoris*, which serve to move the Thigh semicircularly inward or outward, are annexed to a strong, tendinous Membrane that shuts intirely this Hole.

The *Os Pubis* are slenderer and larger in Women than Men; and those who have them advanced more outwardly, undergo their Labour the easier; though I am not of *Bartholin's* Opinion, who pretends that they separate asunder in the Time of Delivery; since the Anatomists, who have opened and dissected Women newly brought to Bed, have not been able to separate them without a great deal of Pains. This Error of their Separation may have been occasioned, perhaps, by the Cartilage which joins the two *Os Pubis* together, being of a pliable Substance. This Cartilage in hard and painful Labours may be distended a little, but not to facilitate alone the Delivery of the *Fetus*.

We'll conclude our *Osteology* by a Demonstration of the Bones of the Extremities.

These Extremities are superior and inferior; both the one and the other are like so many Branches springing from the Trunk, and growing to it; the first are the Hands, and the second the Feet. We'll begin with the Bones of the Hands.

The *HANDS* are divided into three Parts, the Arm, the Cubit, and the Hand. The Arm consists of one Bone only; the Cubit of two; and the Hand of seven and twenty; but we must examine, first, the *Scapula*, or Shoulder-blades, comprehended in the Number of sixty-two Bones that compose the Arms.

The *SCAPULA*, (A) or Shoulder-blade, is the Bone that forms the Shoulder, defined, a large and slender Bone,

Bone, especially in the Middle, and thick in the Proceſſes: It is ſituated at the poſterior Part of the ſuperior Ribs, where it ſerves inſtead of a Buckler to them. There are four Things to be obſerved in it; its Figure, Connections, Parts and Uſes.

The Figure of the *Scapula* (B) is triangular; of which two Angles are poſterior, and the third anterior. It is convex without, and concave within, both for its better Appoſition in the Ribs, and for containing a Muſcle, of which I ſhall ſpeak hereafter.

It hath three Sorts of Connections, one by *Arthrodia*, with the *Humerus*, having at its anterior Angle, a glenoide Cavity, which receives the Head of the *Humerus*; this Cavity is covered over with a Cartilage, that facilitates the Motion, and it hath a ligamentous Brim, which, by making the Cavity deeper, and embracing the Head of the *Humerus*, ſtrengthens its Articulation; the other is made by *Synchondroſis*, with the Clavicle, by means of a Cartilage that unites this Bone with the Clavicle; and the third is made by *Syſarcoſis*, with the *Vertebrae* and the Ribs; there being nothing but Muſcles in all the poſterior Part, that unite it with the adjoining Bones.

There are a great many Parts to be conſidered in this Bone. Firſt, its *Baſis*, which is in its poſterior Part, ends next to the *Vertebrae* of the Back; this *Baſis*, and with two Angles, the one ſuperior, and the other inferior; the Parts coming from theſe Angles towards the Neck, are called the *Coſtae* of the *Scapula*, of which there are alſo two, the one called the upper *Coſta*, which is the ſlendereſt and ſhorteſt; and the other the lower *Coſta*, which is the thicker, and the longer.

The two Surfaces of this Bone differ one from the other; the Internal is hollow, to lodge the ſcapular Muſcle; the External is elevated, to form a conſiderable Eminence, which from the Bottom of the *Baſis*, riſes ſtrait upwards, called the Spine of the Shoulder-blade, the End thereof is called *Acromium*, from its Reſemblance to an Anchor.

On each Side of this ſame Spine, there are two Pits, one above, called *Foſſa ſupra Spinata*; and the other underneath, called *Foſſa infra Spinata*, greater than the former; becauſe, beſides the *Muſculi infra Spinati*, it contains ſome other Muſcles, which ſerve for the Motion of the Arm; and in the Middle of the Spine, there is a crooked Eminence, called the Creſt, or the Wing of a *Batt*, from its Reſemblance to it.

The Proceſſus *Caracoides*, placed at the ſuperior Part of the Neck, and which advances above the Head of the Shoulder-Bone, ſtrengthens the Articulation of the Shoulder, and gives Riſe to one of the Muſcles of the Arm, called alſo *Caracoides*.

The two other Cavities, one between the Neck of the *Acromium*, and the other between its ſuperior *Coſta*, and the *Apophyſis Caracoides*, ſerve for the Paſſage of Veſſels; and that Cavity which is at the End of the exterior Angle, is called the glenoide Cavity.

The Uſes of the Shoulder-blade, are, 1. To give Origin and Inſertion to the Muſcles, like all the other Bones. 2. To faſten the Arm to the Body. 3. To ſupport the Arm, that it may more conveniently make its Motions. And 4. To make the Shoulder, and defend the internal Parts, with its Bulk and Largeneſs.

The *Arm* is compoſed only of the *Humerus* (C). This Bone is articulated at both its Ends; the upper End with the *Scapula*, by *Arthrodia*; and the lower Part by *Ginglymus*, with the *Cubitus*; and by *Arthrodia*, with the *Radius*. The *Humerus* is alſo joined with the *Radius* by *Arthrodia*, having a Prominence at its End, which is received into the Cavity placed at the End of the *Radius*.—This Articulation cauſes the Motions of the *Cubitus* Inwards, and Outwards.

The *Humerus* is often divided into its Body, (D) and its Extremities, which are two, the one ſuperior, one other inferior.—The Body of the *Humerus* is

long and round; it hath an internal Cavity all its Length, which contains the Marrow; its Figure is not abſolutely ſtrait, but a little hollow on the inſide, and riſed on the outſide, for the ſtrengthening of it in its Actions. The Line obſerved in it, to deſcend and terminate in two *Condyles*, ſerve to faſten more ſtrongly, the Muſcles inſerted in this Bone.—The upper End of the *Humerus* (E) is much larger, and more ſpongy than the lower; it contains a medullary Juice, and is called the Head of the *Humerus*. A little from under this Head, is the Neck, which is a round, and ſomewhat ſtrait Part; and as the Fore-part of this Head appears a pretty long Cleft, which goes to the middle Part of the Bone, and made like a Gutter, to make Room for one of the Tendons of the Muſcle *Biceps*. This Head is not only invironed on all Sides, with Ligaments and Membranes, which come from the *Glenoide* Cavity of the *Scapula*, but is likewise involved with four *Aponeuroſes* of the Muſcles that compaſs it.

The lower Part of the *Humerus* (F) is ſmaller, flatter, and harder, than the other; it is alſo bigger, becauſe it is joined with the two Bones of the *Cubitus*, placed on the Side of one another, and which have two different Motions. In this Place there are three Proceſſes and two Cavities; the firſt called the ſuperior Proceſſus, is a round Head, articulated with the *Radius*. The ſecond, which is the inferior, articulate with no Bone, becauſe it only ſerves for the Origin of the *Muſculi Flexores* of the Hand: This is ſmaller than the former, and is called *Apophyſis Condiloides*. In the Middle of theſe two *Condili*, is a third Proceſſus that is ſmooth, oblong, and made in the Form of a Pulley, round which the *Cubitus* hath its Motions: The two Cavities are near this Proceſſus, one internal and ſmaller; the other external and greater; they receive the *Apophyſes Coronoides* of the *Cubitus*, and the Pulley is received into the Cavity *Sigmatoides* of the *Cubitus*.

The Elbow conſiſts of two Bones, which are not ſo long nor ſo big as the *Humerus*, but both of them much of the ſame Magnitude, though the *Cubitus* is a little larger than the other; they are removed from one another in their Middle, for the more convenient Situation of their Muſcles, for the Paſſage of the Veſſels, and eſpecially for their eaſier Motion; one is called the *Cubitus*, and the other the *Radius*.

The *Cubitus*, (G) or Bone of the Elbow, is articulated at both Ends, at its upper End two ways; with the lower End of the *Humerus*, by *Ginglymus*, and with the upper Part of the *Radius*, by *Arthrodia*, at its lower End, it is alſo joined two Ways, by *Arthrodia*; by its End with the *Os Carpi*, and with the lower Part of the *Radius*, by its lateral, or Side-part.

The *Cubitus* is divided into its ſuperior, (H) middle, (I) and inferior Part (K). Its ſuperior Part has two Proceſſes, and two Cavities; the ſmalleſt of theſe Proceſſes, which has no particular Name, is ſituated before, and the other (called *Olecranon*, and is larger than the former) behind. The *Carpus* is ſupported on this Proceſſus; it makes an acute Angle, when the Arm is bent, and hinders it from bending backwards. Theſe two Proceſſes enter into the two Cavities, ſituated on the lower End of the *Humerus*. Of the two Cavities, at the ſuperior Part of the *Cubitus*, the greateſt, called *Sinus Sigmatoïdes*, is placed between the two Proceſſes, and receives the End of the *Humerus*. There is a Line, or Eminence in the Middle of this Cavity, which goes from one Proceſſus to the other, and enters into the *Sinus* of that Part, which is at the lower End of the *Humerus*. The other Cavity, ſituated on the lateral and internal Part of the *Cubitus*, (which is very ſmall) by receiving the *Radius*, joins them together.—There are three Angles at the middle Part of the *Cubitus*, one internal, and very ſharp, called the Spine; two others not ſo keen, one anterior, and the other poſterior.

Two Prominences, and a Cavity are diſcovered at the

the inferior Part; the first of these Prominences situated at the lateral and inferior Part, is received into the *Glenoide* Cavity of the *Radius*; the second, called *Styloides*, and placed externally at the End of this Bone, serves to fortify the Joint; and the Cavity at the End of the Bone helps to make an *Arthrodia*, with the *Carpus*.

The second Bone of the Elbow, called *RADIUS*, (L) is articulated like the *Cubitus* in its superior, and inferior Part; in its superior Part two ways, both by *Arthrodia*, the one with the External *Condylus* of the *Humerus*, and the other with the *Cubitus*; in its inferior Part, either with the *Os Carpi*, or with the *Cubitus*, and both Ways by *Arthrodia*.

The *Radius* is also divided into three Parts, the superior (M), the Middle (N), and the Inferior (O). It has in its superior Part, a Head, a Neck, and a Tuberosity: The Head is round and smooth, for its better Motion, and over it a *Glenoide* Cavity, that receives the superior *Condylus* of the *Humerus*; the Neck is very long for oblique Motions; under this Neck is situated the Tuberosity or Eminence, into which the *Musculus Profundus*, and one of the *Flexores* of the Thumb are inserted. There is an acute Angle in its Middle, called the Spine, which grows still bigger, as it comes nearer to the Wrist, contrary to the *Cubitus*, that lessens according as it is elongated from the Elbow.

There are many Sinuosities and Inequalities observed at its inferior Part, made to avoid hurting the Tendons, that go to the outward Part of the Hand. There are likewise two Cavities, one at its Extremity, which receives the Bones of the *Carpus*; and the other at its lateral and internal Part; but smaller, for a Prominence of the *Cubitus*. The Prominence at the external Part of its Extremity, form, with the *Apophysis Styloides*, a great Cavity, which receives the Bones of the *Carpus*, and hinders their Luxation.

The Hand is made up of the *Carpus* or *Wrist*, the *Metacarpus*, and the Fingers. It begins where the Bones of the Elbow end, and it terminates with the Ends of the Fingers.

The *Carpus* (P) or *Wrist*, which is the first Part of the Hand, is a Heap of Bones, situated between the inferior Articulation of the Elbow, and the *Metacarpus*. These Bones are eight in Number, placed in two Rows, (Q) four in each Row.—Of the four Bones of the first Row, the two greatest are received into the Cavity of the *Radius*, by their upper Part, for the Motion of the Hand; and touch the three first Bones of the second Rank, by their lower Part. The third, next to this in Bigness, is placed in the Cavity, at the End of the *Cubitus*, joining to its *Apophyses Styloides*; and united in its lower Part, with the fourth Bone of the second Rank. The fourth Bone of the first Rank, (the smallest of them all) is situated upon the third, on the Inside of the Hand, making a Prominence, like unto the crooked Process of the fourth Bone of the second Rank.

The first Bone of the second Row, is placed more within the Hand than without, that it may the better support the Thumb, and answer to the crooked Process of the fourth Bone of the same Rank. The second and the third, support the first and second Bones of the *Metacarpus*; and the fourth and last Bone of the *Carpus*, supports, by its two small *glenoide* Cavities, the third and fourth Bones of the *Metacarpus*.—The Figure of the Bones of the *Carpus*, joined together, is round, and raised on the Outside, but it is unequal and hollow on the Inside, for the Facility of the Motion.

There are three Sorts of Articulations in the Bones of the *Carpus*; the first, with the Bones of the Elbow, by *Arthrodia*; the second, with the Bones of the *Metacarpus*, by *Amphiarthrosis*; and the third, by *Synchondrosis*, between themselves.—None of these Articulations has a manifest Motion but the first.

The *METACARPUS*, (R) which is the second Part of the Hand, makes its Palm, by its internal

Part; and its Back, by its External.—The *Metacarpus* is composed of four long, slender, and unequal Bones, each of them having a Cavity that contains a Marrow. These four Bones are joined with the *Carpus*, by a strong Connection, by means of many cartilaginous Ligaments, which allows them but an obscure Motion; and with the Fingers, by *Arthrodia*; each of them having a round Head at their End, which enters into the *glenoide* Cavity, placed at the End of the first Bone of the Fingers.—Besides these two Articulations, they mutually touch, and are united together by their lateral Part, very near the Place where they are joined to the *Carpus*, and this for their greater Strength.—They afterwards separate towards the Middle, in order to leave a convenient Space to the *Musculi interossei*.

The middle Part of these Bones is of a round Figure, though a little convex outwardly, for Strength sake; and a little hollow inwardly, for the better taking up Things.—Their superior Extremity, whereby they are united with the *Carpus*, is their largest Part; and their lower Extremity, which ends with a Head that joins them with the Fingers, their smaller Part.—These four Bones are not equally large, that which supports the *Index*, is larger than the others; the next to it less; the next to that lesser; and the fourth the smallest of all. This last is the Supporter of the little Finger, and has a more apparent Motion than the three others.

There are five FINGERS (L) which differ from one another, both in Bigness and Length.—The first, called the *Thumb*, is bigger and stronger than the others, and the only one opposite to the rest in the Matter of Apprehension.—The second is called the *Index*, (U) because we make Use of it when we shew, or point at something; the third, the *middle Finger*, (X) by Reason of its Situation, and is the longest of them all; the fourth, *Annularis*, (Y) because the Ring is worn upon it; and the fifth, (Z) *Auricularis*, because being little and pointed, some commonly use it to cleanse their Ears of *Sordes*.—The Bones of the Fingers are fifteen, three in each Finger, placed in three Ranks, called *Phalanxes*, from their Resemblance to the Ranks in Battle-array.—The first Rank is of larger Bones than the second, and the second than the third, which is the smallest; and whose Extremities end in a Semi-circle or Crescent. The Figure of these Bones is hollow on the Inside, for the Convenience of Flexion; convex on the Outside, for strength Sake, and a little flattened on the Inside, that they might not hurt the Tendons of the *Flexores*, and for the better bending the Fist.—They are joined together by *Ginglymus*, all of them having both little Bones, and little Cavities, which reciprocally receive one another; their Articulation with the *Metacarpus*, is by *Arthrodia*.—Each Finger has likewise Ligaments the whole Length, on the Inside; and these Ligaments tie these Bones mutually together.

We will conclude our *Osteology* with the Bones of the lower Limbs, which are those of the Leg.—By the *Leg* is understood all that is comprehended from the *Os Illium* unto the Ends of the Toes.

We will divide the *Leg*, as we have done the Arm, into three Parts, the *Thigh*, the *Leg*, and the *Foot*.

The *FEMUR* (A) or Thigh, is made like the *Humerus* of one Bone only, the greatest and strongest of all the Bones of a human Body, and which alone bears the Burthen or Weight of the whole.—This Bone has two strong Articulations at both its Ends; the first and superior, called *Enarthrosis*, is made by the means of a very large Head received into a great Cavity. The Head is at the End of the *Femur*, and the Cavity at the lateral Part of the *Os Illium*; This Cavity has a cartilaginous Brim for the better inclosing this Head, and to hinder it from Luxation; which Head is tied besides by a strong Ligament to the Bottom of the Cavity.—The second Connexion is made at its lower End by *Ginglymus*, having two

Heads which are received into two Cavities, situated at the superior and extreme Part of the *Tibia*. Between these two Heads there is a Cavity, which receives a Prominence of the same *Tibia*, and makes the *Ginglymus*.

The *Femur* is divided into a superior, middle, and inferior Part.

The Superior has a Head, Neck, and two Processes. The Head, (B) which is large and round, is formed of that Process which is inserted into the *Cotylo* of the Hips, from the little Pit that is in its middle Rise, the Ligament that ties it unto the *Os Illium*. The Neck, for the Support of this large Head, is also very large, and long, inclining outwardly, not only for the convenient Situation of the Parts of the Thigh, but for the stronger Going. This Neck is oblique, because the Cavity of the *Ischium* not being situated in a strait Line, the Head of the *Femur* had not been able otherwise to enter well into it. Moreover this Neck stretching thus outwardly, separates these two Bones from one another, and causes the Rest of the Bones to descend in a strait Line, and the Body to be more conveniently and surely supported.

The two Processes behind the Neck of the *Femur* are called *Trochanters*, divided into the great and lesser *Trochanter*.—The great *Trochanter*, which is also the superior, gives Insertion to the *Musculi Extensores* of the Thigh, and for this Reason its exterior Part is rough and unequal, that they may insert the better; and at its internal Part, which regards the Neck, there is a Cavity, over which there is found a Kind of *Sinus*. This Bone has a great Cavity, its whole Length (C) which contains Marrow; it is Convex outwardly, and a little crooked or concave on the Inside, inasmuch that it serves for a Buttreffs to our Body, to hinder it from falling and from inclining too much forward.

At the inferior Part of the *Femur* (D) there are two Processes called *Condyl*, covered with a large Cartilage, as all the other Extremities of Bones.—Between these *Condyl*'s there is a Cavity which receives the Prominence of the *Tibia*. Likewise at the upper Part of the *Femur*, there is a Vacuity which gives a Passage to the Vessels that go down to the Leg. This Vacuity is invested like all other Cavities, as well as the Processes which serve for the Connexion of the Bones. They are plastered over with a smooth and slippery Cartilage, in the Mass of which there are small Glands, each of them having a *secretory Duct*, through which runs that slimy Liquor which serves to facilitate the Motion of the Joint.

The *Knee*, placed at the lower End of the Thigh, and at the upper Part of the *Leg*, has a round and large Bone that lies at the Articulation of the *Femur* with the *Tibia*, and called the *Rotula*, (EE) or *Knee-Pan*.—Its Substance in Infants is cartilaginous for some Time, afterwards it comes to be bony. Its Figure is like the circular Boss of a Buckler, its middle Part being thicker, and more prominent than its Brims.—The *Rotula* is moveable, and articulated by a Kind of *Ginglymus*; it is covered with the *Aponeuroses* of the four *Extensores* of the Leg, inserted at its external Part and its Brims. It is invested at its internal Part with a slippery Cartilage, to facilitate its Motion, and serves to strengthen the extensor Muscles of the Leg.

The *Leg*, which is the second Part of the lower Limbs, comprehends the whole Space from the Knee down to the Foot, and has two Bones, one whereof is very big, called the *Tibia*, and the other smaller, called the *Fibula*.—These two Bones differ only in Bigness, being of the same Length; for if the *Tibia* rises higher, the *Fibula* descends the lower; both of them have a triangular Figure, though that of the *Fibula* is more irregular; they are united together at their End, but separated asunder in their Middle to give Room to the Muscles, and a Passage to the Vessels. They also each of them make a *Malleolus* or Ankle-Bone, the *Tibia* making the inward Ankle, and the *Fibula* the outward.

The *TIBIA* (F) is the largest Bone of the Leg, hollow within, its whole Length (to contain the Marrow) situated on the Inside of the Leg, articulated at both its Ends by *Ginglymus*, above with the *Femur*, and below with one of the Bones of the *Tarsus*, called *Astragalus*. It is also joined at both its Ends, but laterally with the *Fibula*, by *Arthrodia*.—The *Fibula* has a small Cavity in its superior Part that receives the *Tibia*, and below a small Prominence received into the *Tibia*, which *Tibia* has also three Parts, the superior, middle, and inferior Part.

The superior Part of the *Tibia* (G) has a Process in its Middle, received into the Cavity, which is at End of the *Femur*. There are on both Sides of this Process two small Cavities, which receive the Heads of the *Femur*. Their Depth is increased by a *Cartilago Lunata*, which is not deprived of Motion, altho' it be fastened by Ligaments.—The middle Part of the *Tibia* (H) has three Angles, the most remarkable thereof is the *Shin*, being long and sharp before like the Edge of a Knife; whence it happens that Blows received upon that Part are very much felt, by Reason that the *Periosteum* which cover it is often cut with the Blow: According as this Bone approaches to the Foot, it lessens in Bigness, but in Recompence it grows harder as it descends.—The inferior Part of the *Tibia* (I) terminates in two little Cavities for the Insertion of the Prominences of the *Astragalus*; and from the Middle of these Cavities there rises a small Protuberance, inserted into the Cavity found at the upper Part of the *Astragalus*; and from the Side of this Cavity there is a pretty large Prominence which forms the internal Ankle.

The *FIBULA* (K) is the least of the Bones of the Leg, situated at its external Part, and articulated at both its Ends by a Kind of more compact *Arthrodia*, fortified by a Ligament both above and below it.—This Bone has also three Parts, a superior, middle, and inferior Part.—The Superior (L) is a round Head which don't touch the Knee, ending a little under it at the Place where it is articulated with the *Tibia*.—The Middle (M) is slender and long, and of a triangular Figure like the *Tibia*, but a little more irregular.—And the lower Part (N) has a *Condylus*, which makes a Process called the outward Ankle; it is a little hollow within for a free Motion of the *Astragalus*.—The lower End of this Bone descends a little lower than that of the *Tibia*.

The *Foot*, (O) which is all that's comprehended from the inferior Articulation of the Leg unto the End of the Toes, is of an oblong Figure; its superior and external Part is Convex, the better to form the Cavity of its inferior and internal one, called the Sole of the Foot. (P)—The Uses of this Cavity are, besides that of contributing to the Convenience of walking, and of standing firm, to leave a free Passage to the Tendons that go to the Toes, and to lodge one of their *Flexores*.

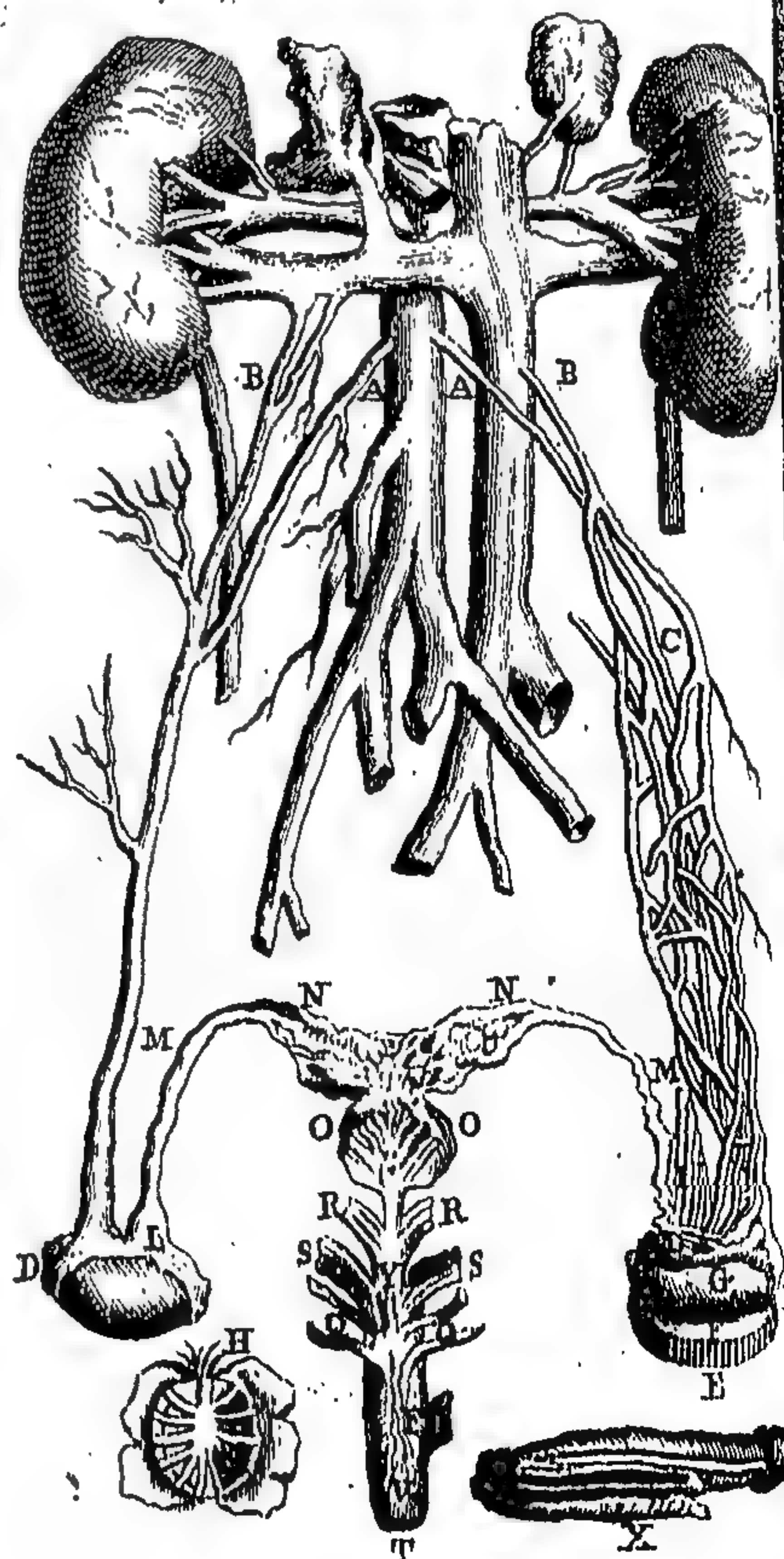
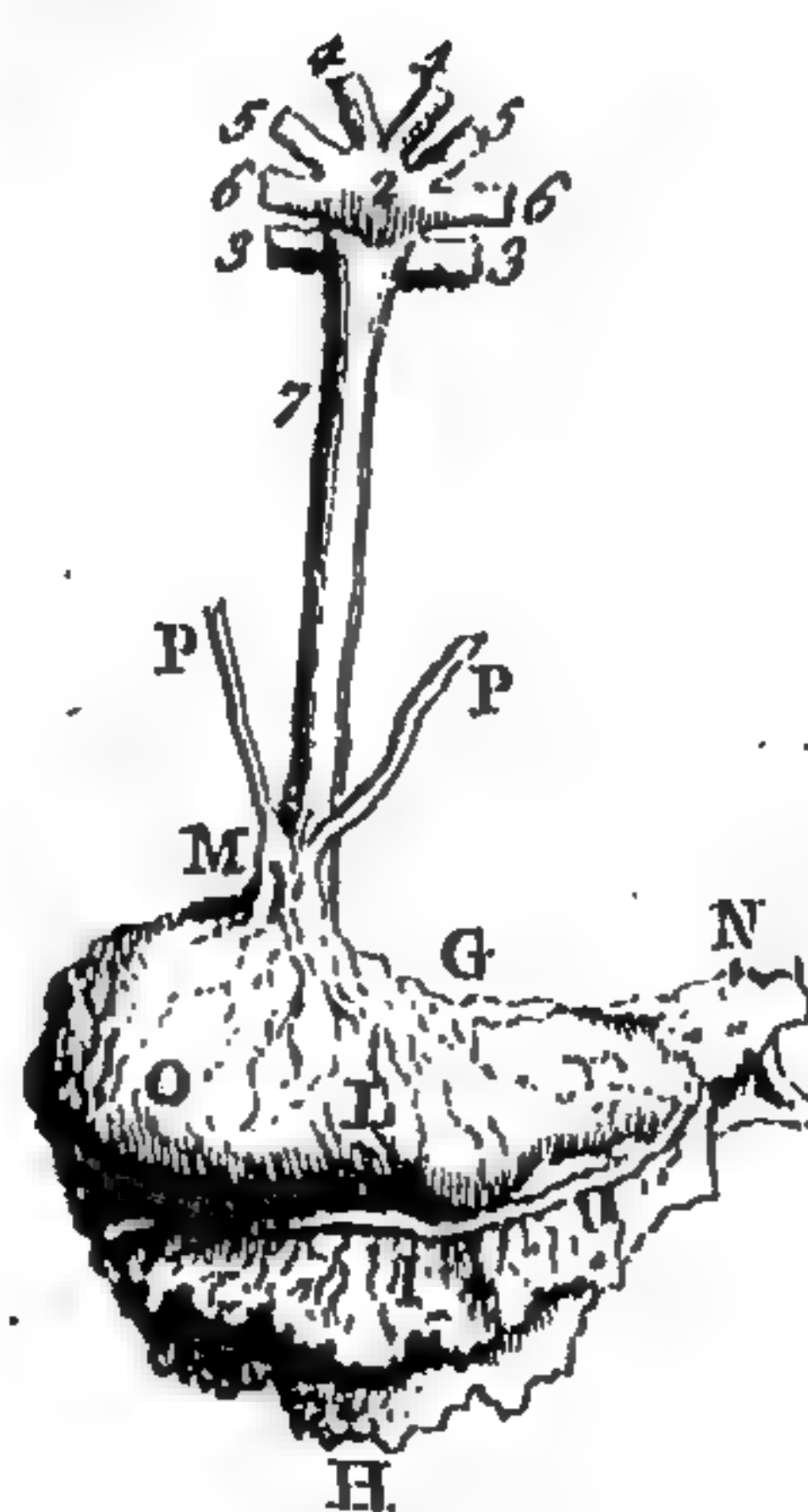
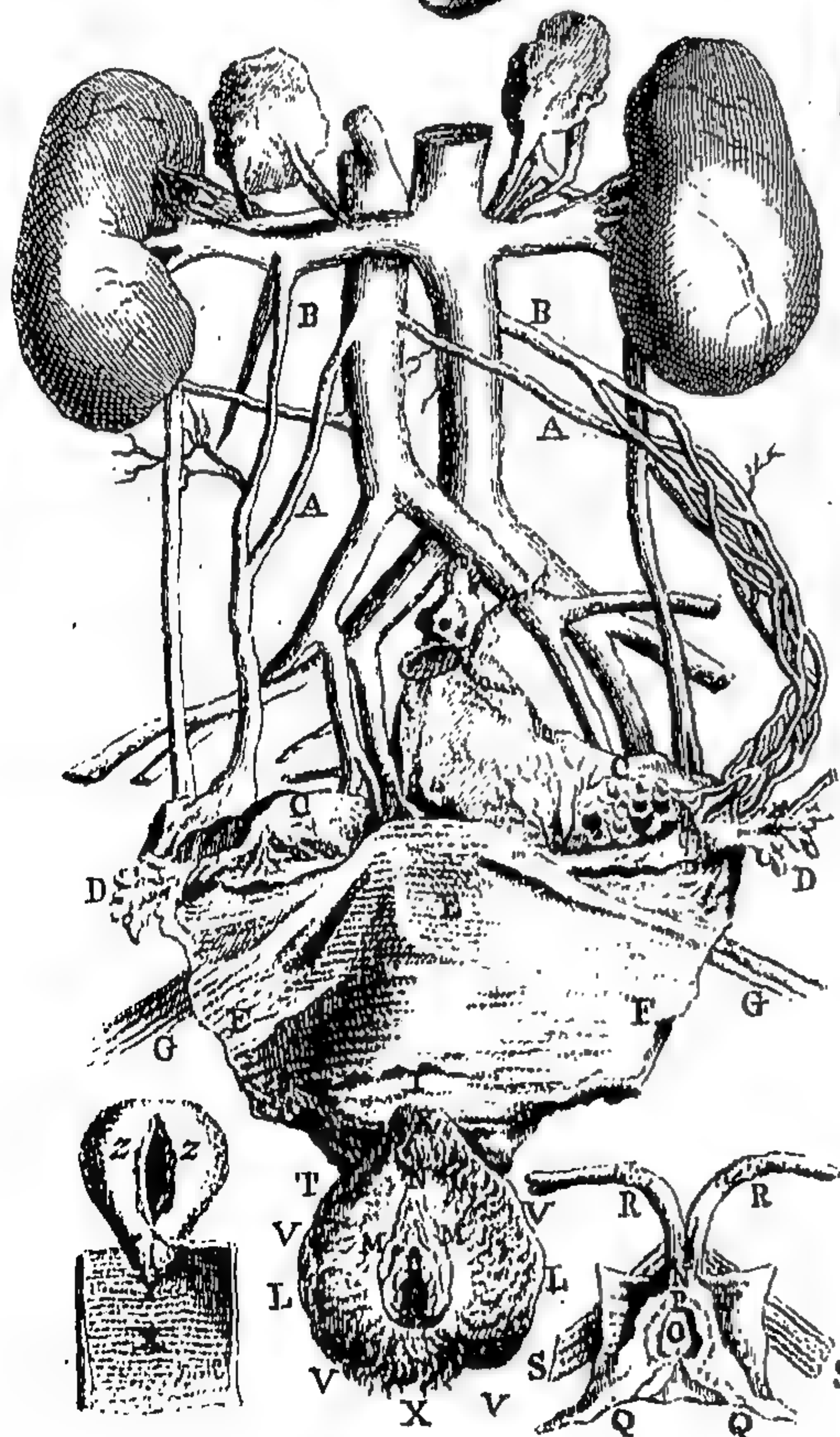
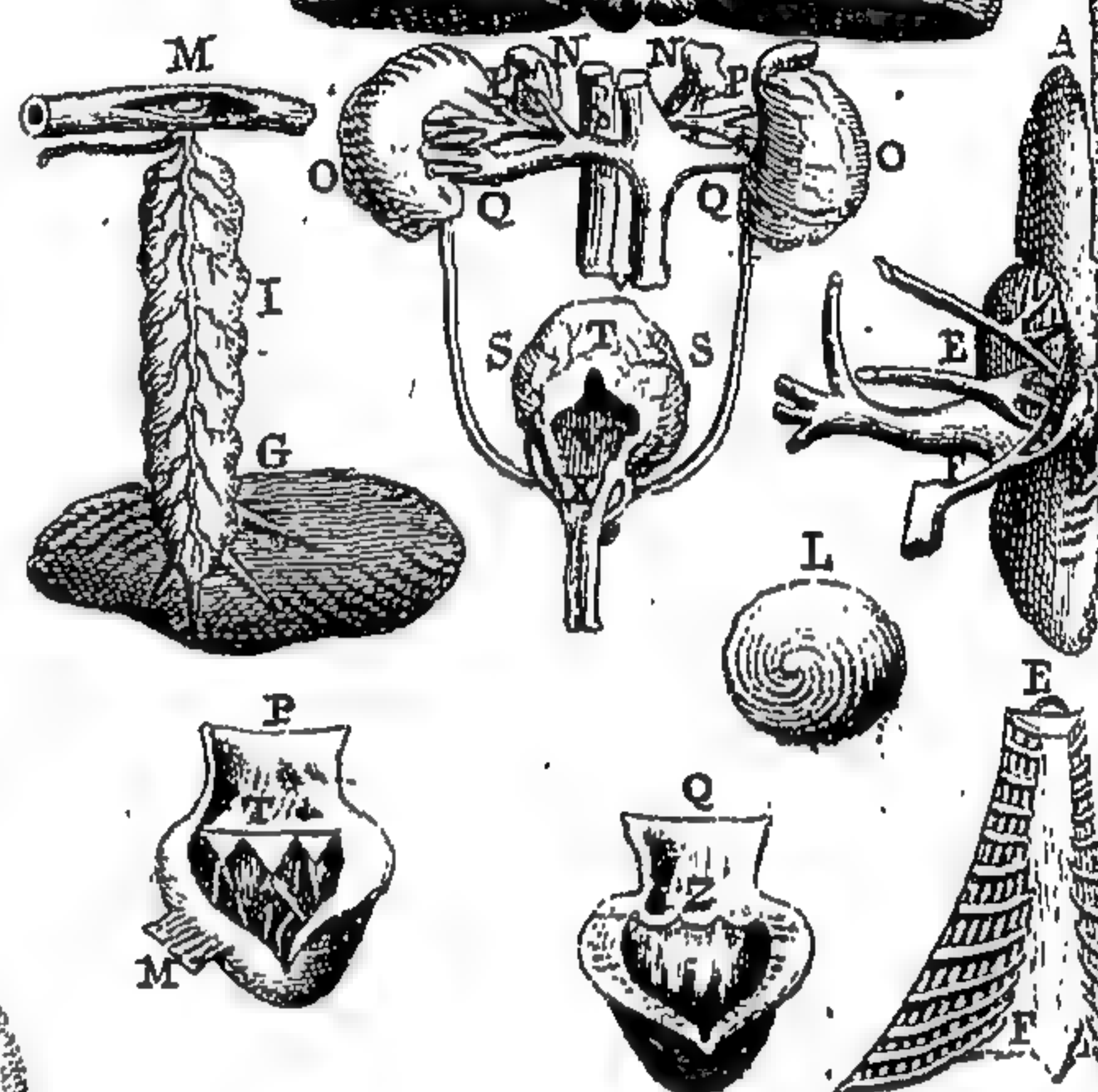
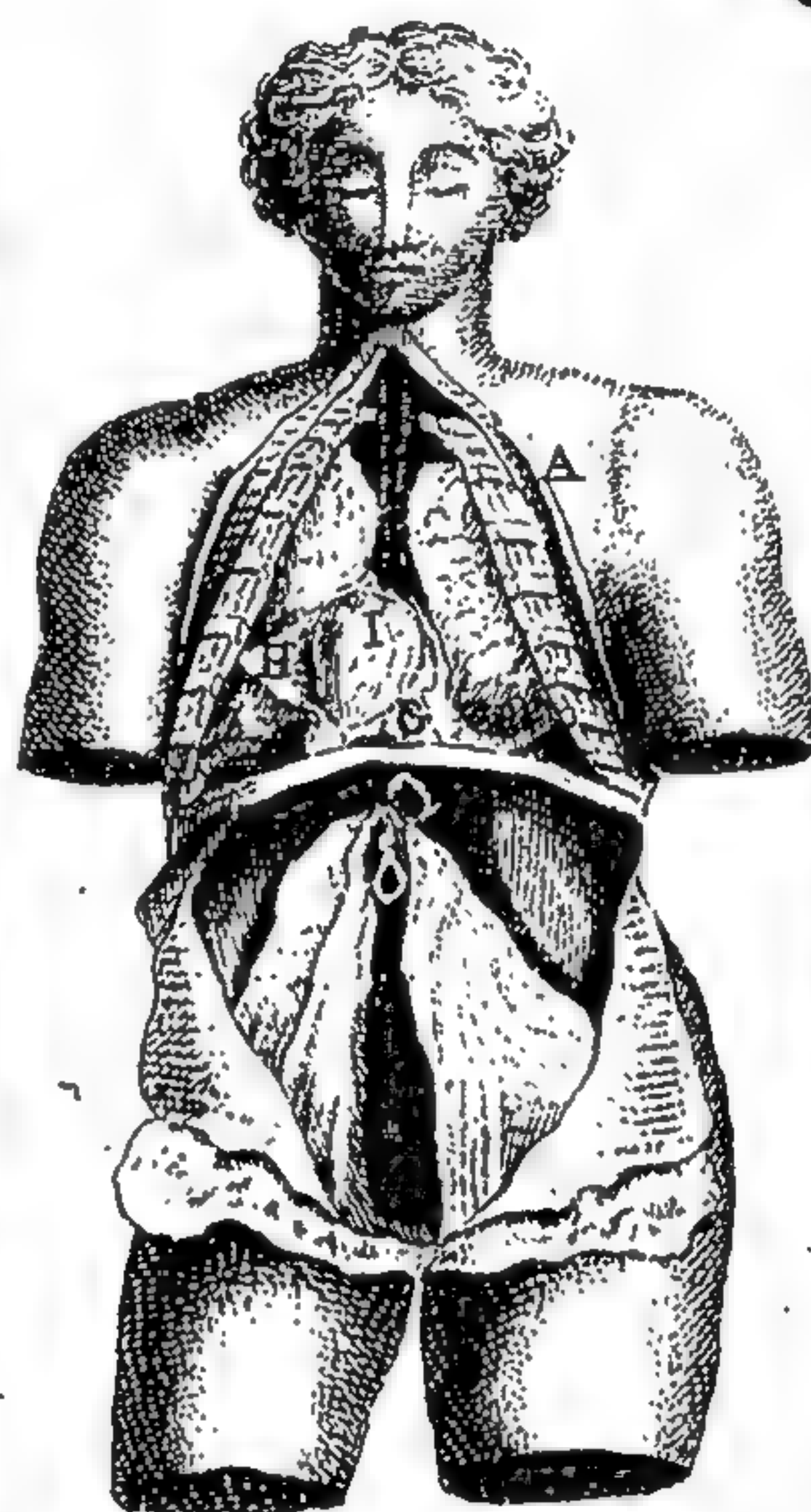
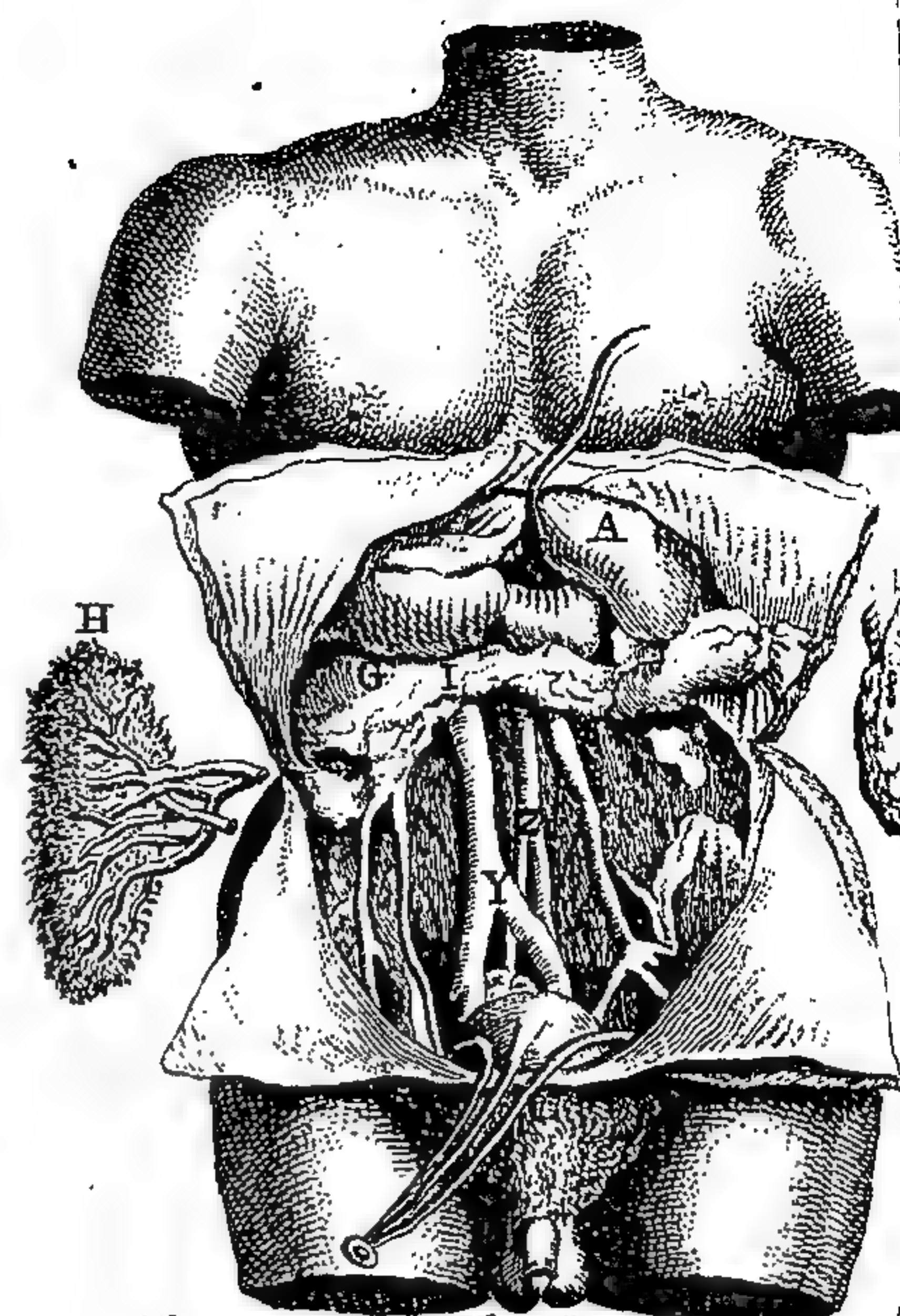
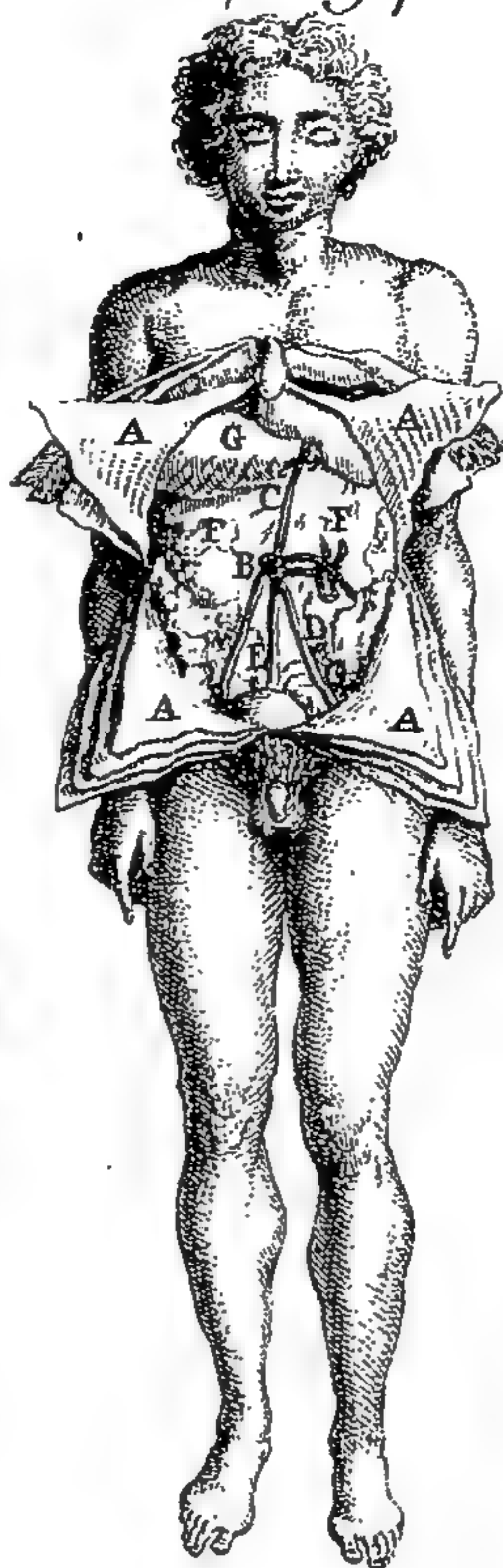
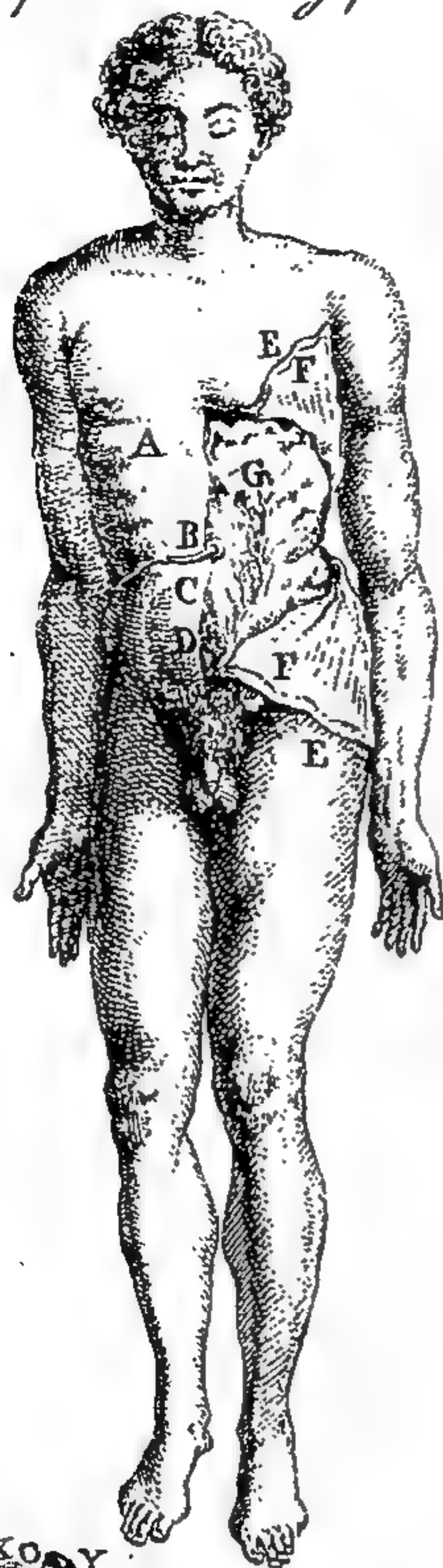
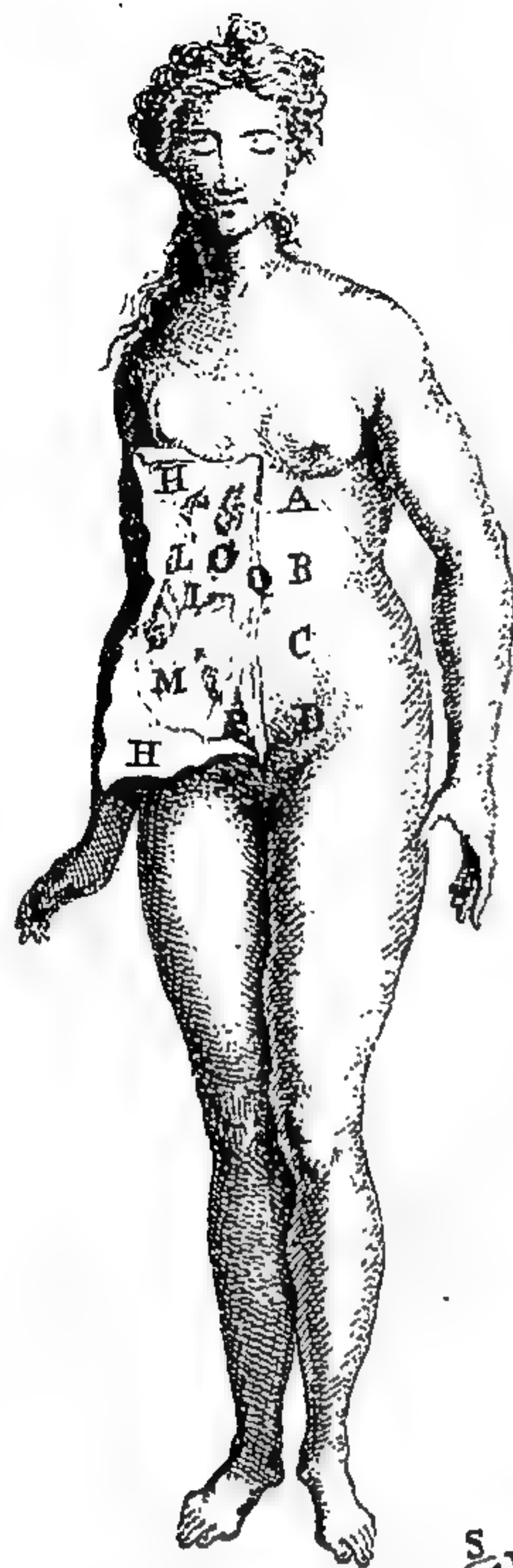
The first and largest Part of the Foot is the *TARSUS*, (Q) composed of seven Bones, four of which have distinct Names, and the three others only that of *Cuneiformia*.—The first is the *Astragalus*, (R) articulated under the Bones of the Leg, and which has six several Surfaces; the first and superior is smooth, and made like a Pulley, upon which the great Bone of the Leg is placed; The second, which is anterior, is a large Head that enters into the Cavity of the *Os Naviculare*, with which the *Astragalus* is strongly articulated; The third and posterior receives the Head of the *Calcaneum*, (S) with which it is strongly united; the fourth and inferior is rugged and unequal; the fifth and sixth Surfaces of the *Astragalus* are the two lateral, inclosed by the two *Malleoli* or Ankles.

The *CALCANEUM*, or Heel-Bone, is the second of the *Tarsus*, the greatest and the most porous, and situated at the posterior Part of the Foot.—In this Bone the Tendon *Achilles*, the biggest and strongest of all the Tendons, is inserted.—It is doubly joined with the *Astragalus*, and also by a flat Head with the *Os Cuboides*.

The

Sarcology

Splanchnology



The Third is the *Os Scaphoides*, (T) or *Naviculare*, from its Resemblance to a little Boat; it has a pretty large Cavity that goes from one of its Ends to the other, for the Insertion of the large Head of the *Astragalus*, which joins them both strongly together; and to the three Protuberances found on the other Side of this Cavity, the three last Bones of the *Tarsus* are articulated.

The *Os Cuboides* (V) is the fourth Bone of the *Tarsus*, situated before the *Calcaneum*, unto which it is joined by an unequal Surface, and articulated with the seventh Bone of the *Tarsus*, whose fifth, sixth, and seventh Bone are called *Cuneiformia*, because they have the Figure of a Wedge that cleaves Wood.—These three Bones, although the same in Figure, differ moreover in Magnitude; for one of them is greater than the rest, another of a middle Size, and the other is the least of all.—They are all three articulated with the *Os Scaphoides* by one of their Ends; and by the other they do one of them support one of the Bones of the *Metatarsus*, the two others being supported by the *Os Cuboides*.

The *Metatarsus*, (Y) or Instep, consists of five Bones, situated Sideways to one another, for the sustaining each of them a Toe. These Bones are compactly join'd together at that End where they are united with the *Tarsus*; but they separate from one another in their Middle for the Insertion of the *Musculi interossei*. They are convex outwardly and hollow within, for the better Reception of the Tendons of the Muscles.—They are long and slender, and end with a little Head, which entering the Cavity at the End of the first Phalanx of the Toes, unite them together by *Arthrodia*.—They differ in Magnitude, like the Bones of the *Tarsus*, and have at their slenderest End a Head covered with a little Cartilage for the freer Motion of the Toes.

There are fourteen Bones of the *Toes*, (Z) two to the great Toe, and three for each of the four others; distributed into three *Phalanxes*, or Ranks, as those of the Fingers: Those of the first Order or Rank, are greater than those of the Second; those of the Second are less, and so of the rest.—They are of the same Figure as those of the Hand, convex without, and concave within; and are articulated with the *Metatarsus*, by *Arthrodia*, and by *Ginglimus* with one another.

There are also found in the Joints of the Bones, of the Hands and Feet, some very small Bones, of the Bigness of a Pea, flat on their Inside, and round without, called *Ossa Sesamoidea*. (aa) Their Number is uncertain, although we commonly count twelve of them in each Hand, and the same in each Foot; those Bones, small as they are, not only serve to strengthen the Joints, and hinder Luxation, but their principal Use is to serve for Pulleys to the Tendons of the Muscles which go to the Fingers, in order to keep them in their due Places, and hinder them from falling upon the Joint.

Here ends our *Osteology*, and the *Sarcology* begins; which is the second, and most essential, and most curious Part of *Anatomy*, as treating of the Flesh, and other the soft and tender Parts contained in the human Body.

SARCOLOGY is divided into three Parts, *viz.* into *Splanchnology*, *Myology* and *Angiology*. The First gives an Account of all the internal Parts, and especially of the *Viscera*; the Second of the Muscles, and the Third of the Vessels; such as the Nerves, the Arteries, and the lymphatick Vessels.

In order to demonstrate well all these Parts, I must divide the human Body (which we all consider as the Subject of *Anatomy*) into the Trunk, and the Limbs; and again subdivide the Trunk into three Parts or principal Regions, which are the Head, the Breast, and the *Venter*, or *Abdomen*; beginning our anatomical Dissertations on the the contained Parts, with the *Abdomen*.

The *ABDOMEN* is all that Cavity, extended from the *Diaphragma* unto the *Os Pubis*.—Its Substance is

soft and fleshy before, and can, therefore, extend, and contract itself freely both for easier Concoction, and for the Expulsion of Excrements, as well as to make room for the Extension of the Matrix, in a Pregnancy.—It is terminated above by the *Diaphragma*; below and before by the *Os Pubis*; on the Sides by the Hip-bones, and behind by the *Vertebrae* of the Lines and the *Os Sacrum*.

The *Abdomen*, is also subdivided into three Regions or Cavities; the Uppermost, called the *Epigastric*, commences from the *Diaphragm* and *Cartilago Xiphoides*, and terminates two Fingers breadth above the Navel; the Second, called the Umbilical, begins where the former ends, and terminates two Fingers breadth below the Navel; the Third, called the *Hypogastric*, descends as low as the *Os Pubis*.—Each of these three Regions, is subdivided into three Parts, a Middle and two lateral Parts; the middle Part of the *Epigastric*, is called *Epigastrium*, and the two Sides *Hypochondria*, of which one is the Right, and t'other the Left *Hypochondrium*. (AA)

The *EPIGASTRIUM* incloses the small Lobe of the Liver and a Part of the Stomach with its inferior Orifice, and also the middle Part of the Colon. The great *Hypochondrium* contains the great Lobe of the Liver, and the Bladder of Gall; and the left contains the greatest Part of the Stomach, and the Spleen.

The middle Part of the umbilical Region (BB) is called the *Navel*; its two Sides are the two Loins; the *Navel* contains the greatest Part of the *Intestinum Jejunum*, and the *Mesentery*; the right Loin contains the right Kidney, the *Intestinum Cecum*, and part of the *Jejunum*, and *Colon*; and the left Loin the left Kidney, and some Part of the *Colon* and *Jejunum*.

The Middle of the *Hypogastric* Region (CC) is called the *Hypogastrium*; its Sides are the *Ilia*, or Flanks, and under it we find the *Rectum*, the Bladder, and the *Matrix* in Women.

The lower Part of the *Hypogastric* (DD) is likewise divided into three, the Middle, or that of the *Pubis*, and two lateral, called the Groins—the *Pubis* begins to be covered with Hairs at fourteen Years old.—The Groins give Passage to the *Spermatic* Vessels.

The posterior Part of the *Venter* extends from the last Rib unto the End of the *Os Sacrum*; and is divided into a superior Part called the Loins, and an inferior, called *Nates*, the Buttocks, between which there is a Fissure, and a Foramen called *Anus*, which is the Sink of the grosser Excrements.—The *Venter*, or Belly, is that Cavity which contains the Parts which serve for Nourishment, and for Generation. It is composed of two Kinds of Parts, whereof the one external, and containing, and the others internal and contained.—The first of these are common or proper; the common Parts containing, are the Teguments; as the *Epidermis* or *Cuticula*, the *Cutis* or Skin, and the Fat. The Proper are; the Muscles of the *Abdomen*, and the *Peritoneum*.

The *EPIDERMIS* (EE) is a very thin Membrane, and strongly fasten'd to the Skin which it covers, and is as thin as the Peel of an Onion.—The *Epidermis* is produced, after the same Manner with the other Parts, it being found in Foetus's of all Ages in the Womb; it has neither Veins, Arteries, nor Nerves, whence it is insensible.

The *Epidermis* has the same Figure, and the same Magnitude as the Skin. In Burns it separates from the Skin, but it regenerates very easily without leaving a Mark afterwards.—Let an Anatomist be ever so skilful or expert, he can never dissect this *Cuticula*, unless he does it by burning a Part with the Flame of a Candle; it is this which rises in large Pustules when Veficatories are applied to some Part of the Body; and when it separates from the Skin without an outward Cause, it is a Sign that the Part has a Disposition to Mortification or Gangrene.

The Uses of the *Epidermis* are to cover the Skin, to render it smoother and equal; to hinder the Evacuation of Humours from the Extremities of the Vessels which terminate to it; and blunt the Sense of touching,

touching, which could not be made upon the Skin without Pain, if the Impression of Objects were to be made immediately upon the Fibres, and upon the Nerves, which end and are inserted into the Skin itself.

The SKIN (FF) is the second Tegument, and the greatest Membrane of the Body, very thick, especially in the Back, at the Kidnies, and in the Limbs; very thin in the Face, and exceedingly so in the Lips.—It has its true Principle, in common, with all the other Parts.

The Skin is formed of Fibres, intertwisted together like unto Nets, which make its Thickness; under these Nets, thousands of small Glands are placed. A small Branch of an Artery comes into every one of these Glands; out of them a small Vein, and a lymphatick Vessel going from the Gland, which passing through these Nets, terminate at the Superficies of the Skin.

The Knowledge, or rather Discovery of this Structure, has taught us in what Manner Sweating is performed; thereby we find, that a sufficient Quantity of Blood being brought hither by so many Arteries, as there are Glandules in it, is carried back again by so many little Veins; and that whilst it is passing through the Pores of the Glandules, a Serum is filtrated from it, which coming through the excretory Vessel, furnishes Matter for Sweat.

There is also another Sort of Evacuation through the Skin, which we call insensible Transpiration, no less advantageous than sweating; because, being made without Intermission, it purifies and cools the Blood, by an absolutely necessary Dissipation thereof, and preserves the Skin moist, as well as the *Epidermis*, which, without it, would become too dry, and hurtful to the Sense of Touching.

The Skin is a Membrane that can extend or contract itself easily, as it is evident, in Women with Child, in hydropical Persons, and in such as grow exceeding big, and fat.—Throughout all its Extent, it adheres to the Parts which it touches; but more in the Palm of the Hand, and the Sole of the Foot, than in the Forehead or Belly.—If the Skin happens to suffer a Solution of Continuity in any Part, it never re-unites without making a Scar, which remains afterwards all the Life.—The Skin of a Man, is all over covered with Hairs, that of a Woman less so.—We don't perceive easily those on the Surface of the Skin; but however, they are more or less discovered, as they are more of a fair, or a dark Colour.—Those of the Head, Arm-pits, Face, and of the *Pudenda* are always very apparent.

Although White is the natural Colour of the Skin, all Men have it not equally so; the Colour often changes, according to the Temper of the Body, and to the predominant Humour. Fat People have it whiter, because the Fat which lies under the Skin, gives them a white Lustre. Lean Persons, on the contrary, have it ruddier, because the Flesh, which immediately touches it, gives them that Colour.

The Skin has three very considerable Uses; the first is to cover all the Parts of the Body; the second is, to be the Organ of Touching; and the third is, to serve for an Emunctory to the *Humours*, which pass forth by Sweat and Transpiration.

The FAT (G) is the third of the common Teguments.—It is a white Body of a middle Consistence, formed of the unctuous and oily Parts of the Blood, and condensed by a certain Degree of Heat, which not being strong enough to dissolve it, cannot be a Hindrance to its Production.—This oily Matter is inclosed in little Bags, called *Cellule Adipose*, adhering to the outward Surface of a Membrane, called *Adiposa*, all over the Body, except on the Forehead, Eye-lids, *Penis* and *Scrotum*.—In some Subjects, the *Cellule* are so full and distended, that the Fat is above an Inch thick; in others they are almost flat; and in emaciated Subjects, instead of Fat, we find a Sort of flaccid, transparent Substance, which is nothing but the bare Membrane.—This Sort of

Fat, is what the Physicians call *Pinguedo*; but there is a second Sort of Fat, called *Adeps*, *Sæbum*, *Serum*, and sometimes *Axungia*, which is whiter, harder, more brittle, and less easy to liquify than the former.

The Fat of both Kinds serves as a natural Balsam to preserve the Body; and by mixing with, and enveloping the Salts, wherewith the Blood and *Serum* are highly saturated, keeps them from fretting and corroding the Parts of the Body, through which they pass.

The Fat has also several other Uses; that which invests the whole Body keeps it warm, whereof those who are fat, are very little sensible of Cold; that about the Heart serves to keep it moist, and pliant in its Motions; that at the Kidnies, preserves their *Pelvis* from being hurt by the Salts of the Urine; and that found near the Joints, facilitate their Motion, by its Lubricity.—For which Reason, there is Abundance of it found in Places, where the Motions are great and violent, as at the Heart, and the Eye.

It is thought, likewise, and not without Probability, that the Fat makes a considerable Part of the Nourishment of our Body; whence the fattest Persons falling into an *Astrophy*, gradually lose all their Fat, which is always quite expended in such Cases, before the Disease becomes fatal.

Too much Fat is usually attended with Heaviness, and Drowsiness, not only from the Unwieldiness of an overgrown Body, nor from the stuffing the Cavities and *Thorax* alone, which sometimes obstructs the Expansion of the *Diaphragm* and Lungs, and produces a *Dispnoea*, or an *Orthopnoea*; but it is likewise probable, that the Abundance of fatty, or oily Particles returned into the Blood, and implicating the more subtle and active Parts, may hinder the necessary Secretions in the Brain.

There are ten Muscles which possess all the anterior Parts of the *Abdomen*; which are the four oblique, two transversal, two *recti*, and two pyramidal.—They all receive their Names from their Situation, and from the Order and Disposition of their Fibres.—By Means of those Muscles, the *Abdomen* can expand and contract itself.

Of the four oblique Muscles, there are two of them descending and external, and two ascending and internal: Those which appear first, after the raising of the Teguments, are the obliquely descending (L) so called, because their Fibres descend obliquely from above downwards; they are also called external, to distinguish them from those placed under them; and great *Obliqui*, because they exceed the others oblique in Magnitude.—Their Figure is triangular.

They proceed by Digitation, from the *Serratus Major*, i. e. from the sixth and seventh of the true Ribs, from all the bastard Ribs, and from the Edge of the transversal Process of the *Vertebrae* of the Loins; are inserted in the external Part of the *Os Illium*, and of the *Os Pubis*, and end with a large and strong *Aponeurosis* in the *Linea Alba*.—These Muscles are indented with the *Serrati Majores*, which are Muscles of the *Thorax*, by five or six Digitations, each whereof receives a Nerve from the Interstices of the Ribs.

The obliquely ascending Muscles (M) so called, because their Fibres rise from below, upwards, are situated just under the former, and are a great deal less.—They proceed from the superior Part of the *Os Pubis*, and terminate with a large double Tendon in the *Linea Alba*; the upper Part whereof creeping over the *Rectus*, and the other creeping under it, and joining together at the *Linea Alba*, do, as it were, sheath the *Rectus*.

The Transversal (N) are situated under the oblique, placed upon the *Peritonæum*, proceed from the Processes of the *Vertebrae* of the Loins, are inserted in the internal Part of the *Os Illium*, and of the Cartilage of the lower Ribs, and passing under the *Rectus*, terminate in the *Linea Alba*, by a large *Aponeurosis*.—They are perforated in their middle Part to give Passage to the umbilical Vessels; and at their lower Part for the

Communication in Men, of the spermatick Vessels with the Testicles; and so in Women the round Ligaments of the *Matrix*; which proceed to make their Insertion in the Thighs.

The fourth Pair of the *Muscles* of the *Abdomen* are the *Rekti*, (O) which arise from the *Sternum*, and the Extremity of the last two Ribs, and go strait down to the fore Part of the *Abdomen*, to be inserted in the *Os Pubis*.— They have three, four, sometimes more tendinous Coarctations of their fleshy Fibres, which divide them, as it were, into so many distinct *Muscles*.

The *Rekti*, or *Rektus*, has Veins and Arteries which creep on its Inside from the Mamillary and Epigastric Vessels, which communicate together that the Blood may return by the mamillary Veins, when the Passage is stopped by the Epigastric which are compressed in Women with Child.

The two *Piramidal Vessels* (P) of the *Abdomen*, lie upon the lower Tendons of the *Rekti*, proceed from the upper and internal Part of the *Os Pubis*, and terminate in a Point in the *Linea Alba*, three or four Fingers Breadth above the *Os Pubis*, and sometimes reach the Navel.

Fallopian, *Riolanus*, and *Gelee*, pretend that those *Muscles* serve to fortify the Tendons of the *Rekti*; That they help the Excretion of the Urine, and contribute to the Erection of the *Penis*; though their sole Function is to raise the *Peritonæum*, and hinder the Region of the Bladder where they are inserted from too much Compression, that one be not obliged, or rather forced to make Water as often as the other *Muscles* compress the internal Parts.

The *LINEA ALBA* (Q) is a Concourse of all the Aponeuroses of the *Muscles*, I have heretofore mentioned; it is called *Linea*, a Line, because it is strait like a Line, and white, because there's no Flesh in it.— It extends from the *Cartilago Xiphoides* unto the *Os Pubis*. It is straiter below the Navel than above it, and divides the *Muscles* of the right Side from those on the left.

The *PERITONÆUM* (aaaa) is a thin soft Membrane, covering and containing all the *Viscera* of the *Abdomen*.— The Figure and Size of the *Peritonæum* answer to those of the *Abdomen*, which it lines throughout; its internal Surface is smooth, and lined with an unctuous Humour, serving to prevent its wounding the Intestines, and other Parts it touches, as well as to lubricate and facilitate their Motion; when the Glands which furnish it are obstructed, the *Peritonæum* grows thick, as is frequently found in Dropsies.— Its external Surface is fibrous and unequal, that it may adhere more firmly to the *Muscles* of the *Abdomen*, *Linea Alba*, *Ossa Pubis*, *Ischium*, *Ilium*, *Sacrum*, and the *Vertebrae Lumbares*, to which it is fastened; and from the last whereof many suppose it to have its Origin.— It is also connected to the inferior or convex Surface of the Liver, which it suspends by a strong Ligament, called *Suspensorium Hepatis*.

The *Peritonæum* is double every-where, but, most apparently so from the Navel to the *Os Pubis*, and near the *Lumbar Vertebrae*, as appears not only from its extraordinary Thickness in both, but from its spontaneous parting in the latter, to receive the Kidneys.— It is perforated in the upper Part to give Passage to the *Oesophagus*, *Aorta*, and *Cava*; in the under for the Fundament, the Neck of the *Matrix*, and the Vessels that go to the Thighs; and in the Fore-Part to give Passage to the umbilical Vessels.

Its exterior Coat has two Processes, which in Men fall down into the *Scrotum*, wrap up the spermatick Vessels, and dilating make the *Tunica Vaginalis* of the Testicles; in Women they form a Cover for the round Ligament of the Womb.

The *Peritonæum* receives Veins and Arteries from the *Mammaria*, *Diaphragmatica*, *Epigastrica*, *Sacra*, and *Lumbares*. Nerves from the *Os Sacrum* and Loins. *Rudbeckius* pretends to have likewise discovered Lymphaticks, which being scarce visible, are not much taken Notice of.

In morbid Cases great Quantities of Serum have been found between the Duplicatures of this Membrane, when there was none in the Cavity of the *Abdomen*.

The Use of the *Peritonæum* is to contain and keep in their Place the *Viscera* of the *Abdomen*; this is so manifest, that whenever this Membrane happens to be broken, or extraordinarily dilated, some of the Parts are apt to fall down, and to form those Tumors called *Hernias* or *Ruptures*.

The *NAVEL*, (B) is a *Nodus* formed by the Reunion of the umbilical Vessels, and cut so soon as the Infant is born; called also *Umbilicus* from *Umbo*, the Middle, because situated not only in the Middle of the *Venter*, but also in the Middle of the Body.

In a *Fetus* the Navel is a String of a French Ell long, or thereabouts, that goes from the After-Birth to the Belly of the *Fetus*, and then incloses four Vessels, which are a Vein, two Arteries, and the *Urachus*.— This String serves to conduct these Vessels, which would have been too weak of themselves for so long a Passage, and not been able to resist the Motions of the Infant; its Length is of Use to the Infant, that he may remove conveniently to and fro in the Womb, and that both the Infant and the After-Birth may come away one after another in the Delivery. So soon as the Infant is born, this String is to be tied within two Fingers Breadth of his Belly, and then cut above the Ligature. Nature afterwards rids itself of what remains of it, so that there remains only the *Nodus* or Knot, we have heretofore mentioned.— The four umbilical Vessels are annexed to it; the Vein ascends upwards, and the Arteries and *Urachus* descend; and are all four inserted between the *Muscles* and the *Peritonæum*.

My Opinion on the Use of the umbilical Vessels (CDD) is, that the Arteries of the Mother carry a certain Quantity of Blood into the *Placenta*, which being therein dispersed, is received by the Branches of the umbilical Vein, which carries it into the *Vena Porta*, to be filtrated through the Substance of the Liver in the *Fœtus*, before it is to enter into the *Vena Cava*, that carries it into the right Ventricle of the Heart, from whence it passes into the Left through the *Foramen Botalli*, in order to be distributed, afterwards, into all the Parts of the Body by Means of the Arteries. The Superfluity of this Blood is brought by the two umbilical Arteries to the After-birth, where being dispersed, it is received by the Veins of the Mother spread therein, and which carries it into the great Veins to circulate with the whole Mass of Blood; and thus there is made a continual Circulation of the Blood of the Mother to the Infant, and of that of the Infant to the Mother.

The *EPIPLOON* (EE) is a Membrane situated under the *Peritonæum*, which floats upon the Intestines, and follows their sinuous Windings; it extends from the Bottom of the Stomach unto the Navel, where it commonly ends; but when it happens to descend unto the lower Region of the *Hypogastrium*, and even to lapse into the *Scrotum*, then it causes the *Hernia Epiplacela*; and when in Women it happens to slip between the *Matrix* and the Bladder, it makes a Compression on the Orifice of the *Uterus*, and thereby, if we believe *Hippocrates*, hinders Generation.

The Figure of the *Epiploon* is like a Fisher's Net.— It has a great Cavity in its middle Part, formed by two Membranes, one external or anterior, annexed to the Bottom of the Stomach, and to the Spleen; and the other internal and posterior, annexed to the Colon, and to the Back, under the Diaphragm.— The *Epiploon* has small Vessels of Fat, as well as the *Membrana Adiposa*, and which terminate in Globules; this Fat often melts in those that have a Hectick Fever.

The *Epiploon*, when it comes to the Air, corrupts soon; wherefore in Wounds of the *Abdomen* we are obliged to cut off any such Part of it, as has had any Irruption outwards. There are likewise some Dissem-

pers which spoils and corrupts it, as it is easy to observe in scorbutick, pthical, and hypochondriacal Persons.——It has more Vessels than any other Membrane, in Proportion to its Magnitude; for it receives small Nerves from the intercostal Branches of the eighth Pair, many Arteries from the *Cæliack*, and many Veins which discharge themselves into the *Porta*.

The Uses attributed to the *Epiploon* are to warm the Stomach, and thereby help the Digestion; to cover the Intestines; and to conduct the splenick Branch, and the other Vessels which go to the Stomach, the *Duodenum*, or the Colon. Though for my Part I believe that it does more Hurt by the Ruptures it causes, than by its supposed Services.

From the Mouth unto the *Anus*, there is a continued and a very long Body, whose Beginning gives an Entrance to the Nourishment; the Middle receives, and preserves it; and whose End gives a Discharge to its Excrements. The Part from the Mouth unto the Diaphragm is called *Œsophagus*, or Gullet; the next to it, Stomach; and the next, Intestines, or the Guts; and the Membrane which retains them all is the *Mesentery*.

Leaving the *Œsophagus* till I come to the Breast, I'll begin with the STOMACH, (GG) which is an organical Part, destined to receive the Meats after Deglutition, and the principal Instrument of Chylification, situated in the *Epigastrium* immediately under the Diaphragm, between the Liver and the Spleen, and of a round and oblong Figure, resembling a Bag-pipe, particularly when the *Œsophagus* is left with it and a Part of the *Duodenum*.——Its external Surface is smooth and whitish, and the internal wrinkled and reddish; it is annexed above to the Diaphragm, below to the *Epiploon*, on the Right Side to the *Duodenum*, and on the Left to the Spleen.

The Stomach consists of four Membranes or Coats; the First and inmost is formed of short Fibres, which stand perpendicular upon the Fibres of the next Coat, and are plainly to be seen towards the *Pylorus*; when the Stomach is distended with Meat, these Fibres become thick and short, whilst they endeavour to restore themselves by their natural Elasticity; they contract the Cavity of the Stomach for the Attrition and Expulsion of the Aliments.——This Coat is much larger than the rest, being full of Plaits and Wrinkles, and chiefly about the *Pylorus*: These Plaits retard the Chyle that it runs not out of the Stomach before it be sufficiently digested.——In this Coat there are also a great Number of small Glands which separate a Liquor, which besmeares all the Cavity of the Stomach, and helps the Concoction of the Aliments; for which Reason this Coat is called the *Tunica Glandulosa*.

The Second is much finer and thinner; it is altogether nervous; is of an exquisite Sense, and is called *Nervosa*.

The Third is *Muscular*, being made of streight and circular Fibres: The streight run upon the upper Part of the Stomach, between its superior and inferior Orifices; and the circular run obliquely from the upper Part of the Stomach to the Bottom.——Of these the innermost descend towards the right Side, and the outermost towards the Left; so that by their Action both Ends of the Stomach are drawn towards its Middle, and the whole is equally contracted: By their Contraction and continual Motion, the Attrition and Digestion of the Aliments is in great Measure performed.

The fourth *Tunic* is common, and comes from the *Peritonæum*.

The Stomach has two Orifices, the one Superior, and the other Inferior; the Superior (M) one, called the Mouth of the Stomach, is on the left Side, and begins where the *Œsophagus* ends; it is situated over against the eleventh *Vertebra* of the Back, and closely shut up by Abundance of fleshy and circular Fibres, at the Time when it receives no Nourishment, a Thing very necessary, not only for the better Concoction, but

to hinder the Aliments from being cast up again into the Mouth, and also hinder the Fumes, caused by Digestion, from being offensive.

The inferior (N) Orifice, called *Pylorus*, is on the right Side; which although called the inferior Orifice, 'tis only with respect to the other placed a little higher, and not with respect to the Fund or Bottom of the Stomach, since both Orifices are almost equally removed from this.——The *Pylorus* is a little bent, very narrow, because full of transverse Fibres, and is begirt with a thick Circle or a *Sphincter*, that shuts it.

The Stomach sends Veins to the *Porta*, and branches the *Gastrepiploica*, accompanied with others of the *Cæliac*, all lying immediately under the Fourth Coat.

The eighth Pair of Nerves give two considerable Branches to the Stomach (PP) which are spread much about the upper Orifice; by which it is rendered very sensible: Whence also proceeds the great Sympathy betwixt the Stomach, Head, and Heart; on account whereof *Van Helmont* thought that the Soul had its Seat in the upper Orifice of the Stomach.

The Use of the Stomach is for the Concoction of the Aliments, and converts them into Chyle. This Concoction or Digestion, is performed in the following Manner.

The internal Coat of the Stomach, being all over bedeck'd (as we have already observed) with Glandules, which continually transmit into it an acid Juice, the Aliments, after having been pounded in the Mouth, and penetrated with the *Saliva*, which springs from the *Parotide*, and maxillary Glandules, are conducted through the *Œsophagus* into the Stomach, and either by the Help of the acid Juice both of that they find in it, and of that which distils into it without Intermission, they become more liquid; then this Liquor not being able to rise upwards through the *Œsophagus*, by reason of its Situation, and the *Diaphragma* making Compression upon the Stomach, does gently run through the *Pylorus* into the Intestines, where it comes to greater Perfection by the Mixture of the Bilis, and Pancreatick Juice.

The INTESTINES, (QQ) or Guts, are long, round, hollow, and continued Bodies from the *Pylorus* unto the *Anus*; situated under the *Epiploon* in the *Abdomen*, whose whole Capacity they almost fill.——They are knit or annexed to the Back by the *Mesentery*, which ties them together; so that the *Tenuia Intestina* are in the Middle of the *Abdomen*, towards the *Umbilical* Region, and the *Crassa* in the Circumference.

The *Intestines* seem to be nothing but a Continuation of the Stomach, as consisting of the same Number of Coats, and fabricated in the same Manner. They are, when separated from the *Mesentery*, of a very great Length; ordinarily about six times as long as the Person's Height, whose they were; and though they seem to be but one continued Channel, or *Fistula*, yet because in several Parts, their Magnitude, Figure, and Thickness are different, they are generally divided into the Thick and Small, as we have done it already; and these again are each of them subdivided into three. The three Small are called *Duodenum*, *Jejunum*, and *Ilium*; and the Thick, *Cæcum*, *Colon*, and *Rectum*.

They have all of them in common, a Kind of vermicular Motion, which, beginning at the Stomach, is propagated downwards, and is called the *Peristaltick* Motion; to facilitate which, they are generally lubricated with a great deal of Fat, especially the thick ones, whose Surface being somewhat uneven, and the Contents less fluid than those of the small, they need somewhat more to make them slide easy.

The first of the *Intestina Tenuia*, or small Guts, is called *Duodenum*, and reaches from the right Orifice of the Stomach, as far as the *Vertebra* of the Back, on the left Side, where it ends, at the first Angle made by the Intestines, which is about twelve Inches, from which Measure, it seems to have taken its Name.——Into this Gut, the *Meatus Cholodocus*, and

Ductus

Ductus Pancreaticus are inserted; whereunto each of them discharges its Juice, for the second Preparation of the Chyle.

The next *Intestine* is the *Jejunum*, so called, because it is generally found more empty than the rest; which may be occasioned, partly by the Fluidity of the Chyle, which is greater in this Intestine, than in any of those that follow it; and partly by its Capacity, being somewhat larger than that of the *Duodenum*, and therefore gives a freer Passage, and, perhaps also the Irritation of this Gut, through the Acrimony of the Bile discharged into the Intestines, a little before the Beginning of this Gut, may contribute something towards accelerating the Passage of the Contents. However it may seem sufficient, that through the great Number of Lacteals, with which this Gut abounds more than any other, the Descent of the Contents, which are here deprived of their most fluid Parts, should in the rest be more sluggish, by Reason of their great Consistence.—This Intestine possesses, almost the whole umbilical Region; Mr. *Dionis* says, that its Length is an Ell and an Half, *Paris* Measure.

The third of the small Intestines, is the *Ilium*; it possesses almost all below the Navel, and extends, by its Circumvolutions, towards the *Iliac* on both Sides; from whence it takes its Name. It begins immediately where the *Jejunum* ends, and terminates at the *Cæcum*.—It has fewer *Vene Lactææ* than the *Jejunum*, and therefore is always fuller.—This Gut not being so fast tied to the Neighbouring Parts, as the *Colon*, and the *Cæcum*, often fall into the *Scrotum*, and makes the *Hernia Enterocelis*; it is also in this Gut, that the *Volvulus*, or *Miserere* happen, called *Iliaca Passio*, occasioned by its *antiperistaltick* Motion.

The first of the *Intestina Crassa*, is called *Cæcum*, which has a lateral Insertion into the upper End of the *Colon*, and is not perforated at its other Extremity; but hangs to it like the Finger of a Glove, and is about three or four Inches long.—The true Use of this Part is not yet determined; *Bartholin* pretends that the Name of *Cæcum* is given to it, because its Use is but blindly known, and some late Anatomists have thought, that that very Name was mistaken, not allowing this to be the *Cæcum* of the Ancients, which they imagined to be that thick globous Part of the *Colon*, which is immediately appended to the *Ilium*; and therefore they have given this Part the Name of *Appendicula Vermiformis*.—This *Cæcum* or Appendix, is proportionably bigger in Infants than Adults, and in many other Animals, even smaller than in Men; and is at the unperforated Extremity, slightly connected to the right Kidney.

The next of the thick Intestines, is the *Colon*, the largest of them all; it begins at the End of the *Cæcum* towards the right Kidney, unto which it is annexed, and ascending up to the concave Part of the Liver, it touches the Bladder of Bile, which tinges it with its yellow Colour in this Place; from thence it passes along the inferior Part of the Stomach, and fastens to the Spleen and to the Left Kidney; from whence it descends like an S, unto a little above the *Os Sacrum*, and terminates at the *Rectum*, insomuch that it encompasses all the *Abdomen*.—At the Entrance of the *Ilium* into this Gut, is placed a Valve formed out of the Production of the inward Coat of the *Ilium*, which, like the Finger of a Glove, when its Extremity is cut off, hangs loose in the Cavity of the *Colon*; by which Means it stops the Return of the Excrements, though sometimes, as in Inversions of the *Peristaltic* Motion, it proves not sufficient for that Use.—It has a great many *Cellulæ*, or, as it were, distinct Cavities, framed by a Coarctation of the Gut by two Ligaments or Bundles of membranous fleshy Fibres, about half a Finger broad, each running on either Side the Gut opposite to each other, the whole Length of it; and, as it were, girding it in at certain Distances, thereby making it resemble a Glass Incorporator used in mixing Oil and Vinegar.

The last of the Intestines is the *Rectum*, which reaches from the *Os Sacrum* to the *Anus*, and is plain; without Cells. It is fast tied to the *Ossa Sacrum*, and *Coccygis*, by Means of the *Peritoneum*, in Men to the Neck of the Bladder of Urine; and in Women to the *Vagina Uteri*, to which it is strongly connected by a membranous Substance. That Substance of the *Vagina* and Intestine is hardly distinguishable from one another. The Length of this Gut is ordinarily about a Hand's Breadth and an half, and its Capacity about the Thickness of three Fingers; its lower End the *Anus* is furnished with three Muscles, *viz.* the *Sphincter Ani*, and the two *Levatores Ani*.

The *Sphincter Ani*, is like a Ring; its Bigness is two Fingers breadth, annexed, before, to the *Penis* in Men; and to the Neck of the *Matrix* in Women; behind, it is fastened to the *Coccyx*, and laterally, to the Ligaments of the *Os Sacrum*, and to the Hips; it serves to open and shut the *Anus* according to our Will.—The *Levatores Ani* proceed from the inferior and lateral Part of the *Os Ischium*, and insert in the *Sphincter* of the *Anus* to lift it up again, after the Evacuation of Excrements is over.

The Intestines in general are furnished with Blood from the *Mesenteric* Arteries, which is returned by the *Mesaraic* Veins; but the *Duodenum* receives a Branch from the *Cæliac*, which is called *Duodena*; to which answers a Vein of the same Name, that likewise returns the Blood to the *Porta*—the *Rectum* receives others called *Hæmorrhoids*; the Internal from the inferior *Mesenteric*, and the External from the *Hypogastric*, with Veins corresponding of the same Name, that also go to the *Porta*.—These Vessels spread the Intestines with Abundance of Ramifications, and are frequently diversified in several Subjects of the same Species; much less are they to be depended upon, for an uniform Appearance in Animals of different Kinds.—The Nerves of the Intestines come, some of them, from those of the Stomach, and some from the great *Mesenteric Plexus*, which distributes Branches to all the Intestines.

The MESENTERY (V) is a double Membrane situated in the Middle of the *Abdomen*, and of a Figure near unto Circular: If the Elongation of the *Colon*, and the *Rectum* be excepted in it, it has about four Fingers breadth Diameter, and three *Paris* Ells, in its Circumference, round about which the Intestines are folded.—The *Mesentery* contains a vast Number of lateral Veins, which carry the Chyle from the Intestines to the Glands, which are abundantly more in Number in its Center, than in its Circumference.—From these Glandules the Chyle goes by other lacteal Veins, into the common Receptacle, and from thence into the *Ductus Thoracicus*, in order to fall into the left axillary Vein.—The other Vessels of the *Mesentery* are the *Lymphaticks*, which distil their Lympha into the Receptacle, in order to make the Chyle more fluid.

Fat is collected into the *Mesentery* as in the *Epiplon*, from an oily and sulphurous Blood, which evaporates from the Vessels, and retained there by the Thickness of the Membranes. This Fat is to preserve the natural Heat of these Parts, and to moisten the *Vene Lactææ*, which having only a very thin Membrane, and being filled only in the Time of the Distribution of the Chyle, would otherwise grow dry.—The Glandules (X) of the *Mesentery*, have each of them a little Artery, which bring Blood to them, a little Vein which carries back the Blood, and an excretory *Ductus*, which discharges into the Guts what has been filtrated through these Glandules.

The Use of the *Mesentery* is to tie the Intestines together unto the *Vertebræ Lumbares*, and to hinder any Disorder which could happen in their Circumvolutions; and its double Membrane is to shelter from all Dangers the Vessels which pass between them to the Intestines.—The *Mesentery* receives its Nerves from the *Vertebræ Lumbares*, and from the intercostal Branch. They are so interlaced together in the Middle of the *Mesentery*, that they form there a *Plexus*, out of which come abundance of nervous Ligaments,

as fine as Hairs, which overspread the Membranes of the Intestines.

The Arteries inclosed in the Duplication of the Membranes of the *Mesentery*, come from the superior and inferior Mesenterick Arteries, which are two great Branches that come from the Trunk of the *Aorta*, and terminate in all the Intestines.—All the Veins which run through the *Mesentery* unite together as they approach its Basis, and form larger Veins, which larger Veins form a Trunk called the Mesenterick Vein, which joining with another, called the Splenick, make together the *Vena Porta*, which has no other Use than that which is common to all the Veins of the Body, and which is to carry back the Blood to the Heart.

We must observe in this Place that the *VENÆ LACTEÆ*, (Y) which I have so often mentioned already, were never discovered 'till the Year 1622, by *Asellius*, which is the Cause that the Antients have attributed Part of their most essential Functions to the *Vena Porta*.

There are two Sorts of *Venæ Lactææ*, the one called first Lacteal, and the others Secondary; the first bring the Chyle from the Intestines unto the Glandules spread through the *Mesentery*; and the Secondary carry the Chyle from these same Glandules into the Receptacle of *Pequet*, a famous Physician, who in 1651 discovered that Receptacle placed between the two Origins of the Diaphragm, in the Place where the *Lumbares* Glandules are found. The two Branches which proceed from these Glandules joining together form the *Ductus Thoracicus*. This *Ductus* ascends along with the *Aorta*, between the Ribs and the *Pleura*, and terminates by one, two, or three Branches in the left Subclavian Vein, near unto the Axillary Vein, from whence the Chyle is carried into the right Ventricle of the Heart by the descending *Vena Cava*.—This Canal, or *Ductus*, and all the *Venæ Lactææ* have *Valvules* from Place to Place, which give Admittance to the Chyle, and hinder its ever returning.

Bartholin discovered in 1652 the lymphatick Vessels, which some of the Antients had mistaken for the *Venæ Lactææ*.

All these Vessels are employed in the Chylification, which is perfected in the following Manner.—After the Victuals are by the Digestion conveyed into the Stomach, (as I have already observed) and have been penetrated with the *Dissolvent*, so as to appear as an uniform Liquor; that Liquor being squeezed by the Stomach equally on all Sides, is forced through the *Pylorus*, and so enters the Intestines: There it meets with two others dissolvent, *viz.* the Bile, and the Pancreatick Juice, which finish the Liquefaction of the Aliments. This done, it pursues its Course through the Intestines; and mean while the subtilest Part of it enters the Orifices of the first *Venæ Lactææ*, and is carried unto the Glands at the Basis of the *Mesentery*; then that same subtilest Part is taken up by the secondary *Venæ Lactææ*, and conveyed to *Pequet's* Receptacle, where we'll leave it 'till we conduct it to the Heart through the *Ductus Thoracicus*.

The LIVER, (aa) which is the next Part of the *Abdomen*, which falls under our Consideration, is a large glandulous Viscus, of a red sanguine Colour, situated immediately under the Diaphragm in the right *Hypochondrium*, which it almost fills; and then stretching itself over the right Side of the Stomach towards the left *Hypochondrium*, reaches behind the *Cartilago Xiphoides*, growing gradually thinner and narrower.

The upper Part of the Liver is convex and perfectly smooth; the under concave, and somewhat more uneven, having four large Fissures; one through which the umbilical Ligament passes; a Second on the left Side receiving the *Pylorus*, and the Beginning of the *Duodenum*; a Third on the right Side, near the Margin in which the Gall-bladder is lodged; and the

last in the upper Part affording a Passage to the *Vena Cava*.

Its Figure is somewhat approaching round with thin Edges, not altogether even, but notched in some Places.—Its Magnitude is various in different Subjects, according to the Proportion of the Body; though in a *Fetus* it is always larger, in Proportion, than in Adults.—The Liver is fastened by two Ligaments, the First, which is the strongest and chief Ligament, penetrates into the Substance of the Liver and ties it up to the *Diaphragm*.—This suspensory Ligament proceeds from the common *Capsula* of the *Porta*, and Gall Duct.—The other Ligament has its Origin from the external Coat of the Liver, or, which amounts to the same, from the *Peritonæum*, and terminates in the *Cartilago Xiphoides*.—These Ligaments serve to keep it in its due Situation.—Some Authors give in the dry'd umbilical Vein for a third Ligament, which cannot be, since, thereby the Liver and the Midriff, to which 'tis tied, would be drawn downward, and so would hinder its Motion, especially in Expiration.

The Liver has a Motion, not of itself, but depending on that of the Diaphragm; to which being very firmly connected, it must needs obey its Motion.—The Substance of the Liver is vascular and glandulous, which latter Part is very soft and friable, and easily scraped off from the Vessels, to which the Glands every-way adhere, as it were, in Bunches; which has made the Anatomists call the considerable ones, the internal Lobes of the Liver.

The Glands adhering thus to the Vessels, and constituting those Lobes, are wrapped up together in proper Membranes, whence this Appearance of distinct Lobes.—Every one of these Glands, according to *Malpighi*, is composed of six unequal Sides, or Faces.—They are all clothed with their proper Membranes, and have each an excretory Duct; several of which joining together form little Trunks, which run all along with the Branches of the *Porta*; and these again uniting form longer Trunks always full of *Bile*, and which constitute the *Porus biliaris*, which being distributed all over the *Liver*, receives, in the foregoing Manner, the *Bile*, which is separated by these Glands; and terminating in the *Meatus hepaticus*, and in the *Ductus Communis*, at length discharges that *Bile* into the *Duodenum*.—Besides this Discharge by the *Porus biliaris* (supposed to be the great one) the *Liver* delivers also Part of its *Bile* into the Gall-bladder, by a Duct, called the *Cyst-hepatick Duct*, first discovered by Dr. *Glisson*, and therefore called, also, *Glisson's Capsula*, by Means whereof there is an immediate Communication, between the *Porus biliaris*, and the Gall-bladder.

Besides these Gall-vessels, peculiar to the Liver, it has also Nerves, Arteries, Veins, and lymphatick ones.

It receives two Nerves from the eighth Pair, one from the stomachick Branch, and the other from the Intercoastal, which not piercing through its Substance, but only being lost in its Tunics, is the Reason why its Sense is not so quick, as the other Parts which are better stock'd with Nerves.

The *Arteria Celiacæ*, springing from the *Aorta*, divides itself into two Branches, one of which repairs to the *Liver*, and the other to the *Spleen*. The first, which is the least, detaches from it the Gastrick, the two *Cysticæ*, the Epiploick, the intestinal, and the Gastro-epiploick, before it enters the *Liver*; where, at last, 'tis divided into almost as many small Branches, as the *Vena Porta*, which is disseminated, with the *Cava*, through its whole Substance.—And here it is particularly remarkable of the *Porta*, and the *Cava*, that, contrary to the Sentiment of some Anatomists, they are both equally dispersed through the whole Substance of the *Liver*, with this single Difference, that the Branches of the *Porta* arrive there, and those of the *Cava* set out from thence.

The lymphatick Vessels of the Liver, proceed from the

the small conglobated Glands found under the Tunicle of its concave Part, towards the Entry of the *Vena Porta*, in the *Capsula*, of which, *Glisson* says, these Vessels are seen to enter, though they have no Communication with the *Liver*, contrary to *Bartholin*, who first discovered them, and believed that they deriv'd their Original from the *Parenchyma*.—These Vessels serve to carry the Lympha of these Glands to *Pequet's Cistern*.

Although the *Liver*, is not the Organ of Sanguification, as imagined by the Antients, it nevertheless contributes towards the refining of the Blood, which is effected in this Manner.—It is almost unquestionable, at present, that it performs the Office of an Artery, and supplies the *Liver* with Blood, by promoting the Filtration performed in the Glands, which opens into the Extremities of the biliary Vessels, the Capillaries of the *Vena Cava*, and those of the Arteries which convey Blood to them, as well as the *Vena Porta*. Now all this Blood is filtrated in such a Manner, that its Particles, which are proportioned to the Shoots of the Extremities of the biliary Vessels, flow perpetually into them; after which some of them are conveyed, to the Gall-bladder, and others to the Hepatick Duct, and from thence to the *Duodenum*; whereas the other Particles of Blood, the Figure and Size of which is disproportioned to the above-mentioned Orifices, are reconducted by the Capillaries of the *Vena Cava*, into its large Trunk, and at last to the right Ventricle of the Heart; which, the better to perform, Nature has taken Care to join the Hepatick Artery to the *Vena Porta*, that its continual Pulsation may facilitate and augment the Motion of the Venous Blood; and has also placed the *Liver* under the Diaphragm; and the Muscles of the *Abdomen*, that the Concourse of the Blood may be quickened by their continual beating.

In the concave Part of the *Liver*, towards the lower Margin, is the GALL-BLADDER (B), which is a membranous Receptacle, in Figure, somewhat like a Pear, being about the Bigness of a Pullet's Egg; though it is sometimes larger, especially in those of a bilious Temperament.

The *Gall-bladder* adheres to the *Liver*, both by its Vessels, which it receives from it; and by its Membranes; whereas the External is common with that of the *Liver*.—The lower Part, which hangs out of the *Liver*, rests on the *Pylorus* of the Stomach, which it dies yellow, with the Gall transuding through its Membranes.

Its Membranes are five; an outer or common one, from the *Peritoneum*; an inner one, from the *Capsula* of the *Porta*, and *Porus biliaris*; and three proper ones.—The first, *vascular*, consisting of white Fibres, interwove with Vessels. The second, muscular, consisting of a double Row of fleshy Fibres, the one longitudinal, the other angular; the third or inner Coat, glandulous, consisting of a great Number of Glands, like the *Crusta Villosa* of the Stomach, which separates a Mucus that lines the Inside of the *Gall-bladder*, and defends it from the Acrimony of the Bile.

The *Bladder* is usually divided into two Parts, the *Fundus*, or Bottom (C), and the *Collum*, or Neck (D), at the Orifice of which latter, is placed a Ring or Circle of muscular Fibres, which serve as a Sphincter, to constrict it, and hinder the too liberal Discharge of the Bile.

The Duct, called *Cholidocus* (E), is a long Vessel, twice as broad as the Neck of the *Bladder*, which runs straight from the *Liver*, through the common Passage to the *Duodenum*, and throws the Gall directly into that Intestine.

The Common Duct (F), or Passage of the Bile, is formed by the Union of the *Cholidocus*, and *Porus biliaris*. It terminates obliquely, in the End of the *Duodenum*; and sometimes in the Beginning of the *Jejunum*, but very rarely in the Ventricle. It runs between the Coats of the Intestine, and cuts through the outer Coat two Fingers Breadth higher than the

inner.—When any Obstruction happens in this Duct, the *Bile* not having a free Egress, flies back into the Blood, and so occasions a Jaundice, which oftentimes proves mortal.

There are two Sorts of *Bile*, one is subtle and fine, being conveyed by the biliary Vessel to the *Bladder*, and from thence to the Intestine; the other is of a grosser Substance, and being strained out of the Glands of the *Liver*, in which the Shoots of the *Vena Porta* terminate, is carried by small Ducts to the *Cholidocus*, and from thence to the common Passage, where the two Sorts meet; and so repair with joint Forces to the Intestines.

The *Bile* being a potent Dissolver; compleats in the first Intestines, the breaking and mincing of such Parts of the Aliments; as were not entirely dissolved in the Stomach, so that the *Bile* is so far from being a mere Excrement, as fancied by the Antients, that it is a necessary Liquor, without which, the Chyle would never attain to that Degree of Perfection, that is requisite for its Sanguification.

Dr. *Quincy* thinks the principal Use of both Sorts of *Bile*, called by the Moderns, *Cystic*, and *Hepatic*, is to sheath and blunt the Acids of the Chyle, entangling them with its Sulphur, so as to prevent their being sufficiently diluted by the pancreatic Juice to enter the Lacteals.

Borelli asserts, that Part of the *Bile* discharged into the Intestines, re-enters the meseraic Veins, and mixing with the Blood of the *Vena Porta*, is again percolated through the *Liver*; and *Boerhaave* seems of the same Opinion, which, if true, the *Bile* has its Circulation, as well as the Blood.

The *Bile* is a Juice of great Importance, with Regard to the good or ill Habitude of the Animal.—Dr. *Woodward* has traced its Effects throughout the Body, very minutely, and makes no Scruple to ascribe most of the Diseases thereof, to some Disorder of the *Bile*. This he takes to be the chief Spring in the animal Machine, and from this accounts for most of the Phenomena of a Body, whether healthy or diseased.

Many, even among the modern Anatomists, from the small Quantity of *Bile* secreted, have been led into a Mistake, that this Secretion is not the sole End of so considerable a *Viscus*, as the *Liver*. Dr. *Keil* observes, that in a Dog, whose common Duct was near as big as that of a Man, he gathered about two Drams an Hour; though in a human Body, there is Reason to think the Quantity secreted to be greater. Mr. *Tauvry* observes, that the *Bile* becomes one of the principal Causes of Thirst, by mixing with the salival Juice.

Sometimes the *Bile*, from yellow, becomes greenish, like Verdigrase, and frequently pale, like the Yolks of Eggs, and that without any other apparent Cause, than a little Motion, a Convulsion, or a violent Passion of the Mind.—This occasions many and terrible Diseases, as Nausea's, an Abhorrence of Food, Anxiety, Sighing, Cardialga's, Wind, Diarrhoea's, Dysenteries, acute Diseases, Fevers, and Convulsions.

Sometimes it becomes black, and takes the Name of *Choler*: In this Case, it sometimes tastes like a very sharp Vinegar; sometimes like putrified Blood, gnawing, burning, dissolving, consuming, occasioning Inflammations, Gangrenes, Mortifications, violent Pains, and terrible Fermentations.

Of *Astra bilis*, or black *Bile*, *Boerhaave* distinguished three Kinds. 1. The mildest, arising from the Matter of the Blood, put in too great a Motion, which, hence, takes the Name of *Adust*. The 2d, is an Aggravation of the first, arising from the same Causes, only heightened. The 3d, is a corrupt, parched *Bile*, which if it arose from a greenish, or palish Sort, is still worse.

Too great an Evacuation of the *Bile*, either upwards or downwards, robs the Chylefaction of its main Instruments; hence it prevents Digestion, Secretion, Excretion of the *Feces*, produces an acid

Temperature, Coldness, Weakness, Paleness, &c.

The *Spleen* (GG), (the next Part to be considered in the *Abdomen*) is a *Viscus*, of a darkish red, or rather a livid Colour, ordinarily resembling the Figure of a Tongue, though sometimes triangular, and sometimes roundish.—It is situated in the left *Hypochondrium*, between the spurious Ribs, and the Stomach; is somewhat convex on the Side towards the former, and concave towards the latter. Its ordinary Length is six Inches; Breadth, three; and Thickness, one.—It is connected to the *Omentum*, and by Means of that and the Blood Vessels, to the Stomach, and left Kidney, and sometimes to the Diaphragm.

The *Spleen* has but one Membrane, which is very Thick, its inward Surface sends out hard Fibres which run across it: All these Fibres make a Net, the Interstices of which are of different Figures. These Fibres are fleshy, like those of the Lungs.—The Bulk of the *Spleen* is composed of innumerable Cells, or little Bladders, which communicate with each other, and discharge themselves into the Trunk of the Splenic Vein.—Their inside, according to *Malpighi*, is furnished with various minute Glands adhering together; six, seven, or eight whereof form a Kind of small conglomerate Glands, wherein the Arteries and Veins seem to terminate.

Its Blood Vessels are the *Splenic Artery*, which furnishes it with Blood from the *Cæliaca*, and the Splenic Vein, which carries it thence, by the *Porta* to the Liver.—Its Nerves come from the *Plexus Lienaris*, near the Bottom of the Stomach.—The Vessels are all, as soon as they enter the *Spleen*, wrapt up in one common *Capsula*, or Membrane, and plentifully distributed together, throughout the Substance of the *Spleen*. Besides these, are Lymphatics in Abundance.—The *Anastomoses* between the Arteries, and Veins of the *Spleen*, are more apparent than any other Part of the Body; and this *Viscus*, is observed to be furnished with a greater Quantity of Blood, than any other Part.

The *Anatomists* have been divided, in all Ages, upon the Use of the *Spleen*.—Some have imagined the *Spleen* only served to make a Ballance in the Weight of the Body; others, that it was only intended for the Sake of Symmetry; others hold it an useless Load, (since it appears from Dissection, that Animals from whom it has been cut, live very well without it) others a Pit, or common Shore, to discharge the *Fæces* of the Blood into; others a Fire, by the Heat whereof, the Action of the Stomach is animated.

Mr. *Cowper*, from the great Quantity of Blood, and the apparent Inosculations of the *Spleen*, draws a very natural Conjecture of the Use thereof, at least of the peculiar Mechanism.—He takes then the *Spleen* to be only a subordinate Organ, ministering to the Circulation; and thinks, that by this Congress of the arterial and venal Blood, an *Impetus* is communicated to the latter; by which its Progress thro' the Ramifications of the *Porta*, to the *Cava*, is promoted, which would otherwise be so broke, by the double Ramifications of the *Porta*, as to want Strength sufficient to carry to the Heart.

This Action or Effect of the *Spleen*, according to Dr. *Boerhaave*, is to receive the fresh Arterial Blood, prepare it in its Glands, and pour it into its Cells; to return what Blood is left from this Action, to the little Veins, and thence to the splenic Vein; to mix the Humour thus prepared with the nervous Juice, and to prepare, attenuate, and more intimately unite them together into one Humour.

Malpighi and Dr. *Keil* take the *Spleen* to be a viscous Assillant to the Liver, in the Secretion, &c. of the Bile.—And in Fact the Blood may receive some Alteration there, that may facilitate the Secretion of the Bile in the Liver; since Filtration ought always to be ushered in by Precipitation; that is the *Molecule*, or little Particles, should be already separated before

they come to the Strainer, and therefore those of the Bile should be parted from those of the Blood before they arrive at the Glands of the Liver.

The *PANCREAS* is a conglomerate Gland, or a Body composed of a great Quantity of Glands, seated under the lower and back Part of the Stomach near the first *Vertebra* of the Loins; it reaches from the *Duodenum* to the Spleen, the principal Part of it being in the left *Hypochondrium*, 'tis tied very fast to the *Peritonæum*, and weighs about five Ounces; commonly it has ten Fingers Breadth in Length, one in Thickness, and two in Breadth; furnished with a Nerve from the Intercostal, with Arteries from the *Cæliaca*, with Veins leading to the Splenic, and with lymphatick Vessels which run to the *Receptaculum*.

Besides all these Vessels it has a peculiar *Duct*, called the *Pancreatic*, discovered in 1642, by *Virtungus*, a celebrated Anatomist at *Padua*.—This *Duct* running along the Middle of the *Pancreas*, opens into the Cavity of the *Duodenum*, where its Orifice is guarded by a Valve, allowing an *Exit* to the contained Liquor, and opposing the Entrance of the Chyle, and other Liquors contained in the Intestine; there is but one Passage of this Nature, though *De Graaf* observes that it is frequently double; and in its natural State 'tis no bigger than a small Quill.

The *Pancreas* serves neither for a Cushion to the Stomach, nor for Support to the Vessels dispersed over the *Abdomen*, but, by Virtue of its Glands, to separate and strain out a certain Juice from the Blood called the *Pancreatick Juice*.

This Juice is not acid, as some Authors have supposed; nor *Alkaline*, as some others; but a little Saline, and much resembling the *Saliva* in its Origin, Vessels, and Properties.—It is carried by the *Pancreatic Duct* into the *Duodenum*, where it serves to dilute the Bile, to change its Viscidity, Bitterness, Colour, &c. and make it mix with the Chyle, in Order to reduce the several Tastes, Odours, and Properties of the several Foods in an homogeneous one.

Jansson of *Almeloveen*, thought that the *Pancreatic Juice* had been known to *Hippocrates* and *Galen*.—*De Graaf*, a Dutch Physician, had found Means to collect a Quantity of it for Experiments, and has published an express Treatise *de Succo Pancreatico*.

Brunner relates, that the *Pancreatic Duct* having been tried in several Dogs, and cut, they still continued to eat as usual, and performed all the other Functions of Life; one of them seemed to have the better Stomach for it.

Before we proceed to the Kidneys, we must take Notice of two Parts, called *Capsule Atrabiliaræ*, because there is found in their Cavity an Humour resembling the *Atra Bilis*.

Those two *Capsule* are placed sometimes above the Kidneys, and sometimes between it and the great Artery.—They are enclosed in a thin Membrane, and entangled with Fat, which occasions the Difficulty of tracing them.—That on the Right Side is commonly less than the other. Each of them is as big as a Walnut laid flat, and has a Cavity large enough in Proportion to its Bigness.—In a *Fœtus* they are generally as big as Kidneys, from which they differ, in this, that their Substance is softer and more flabby.

Their Figure is as inconstant as their Situation, for, in Fact, they have no determined Figure.—Their Colour is sometimes red, sometimes the same with that of the Fat they are wrapp'd in.—In their Cavity they have small Holes, which penetrate through their Substance.—They have a Nerve derived from the Intercostal, which makes a *Plexus* in this Place; one or two Branches detached from the emulgent Artery, and sometimes from the *Aorta*, and a small *Duct* inserted into the upper Part of the emulgent Vein.—Their Cavity has a Valve, which opens towards the emulgent Vein.

The *Capsule Atrabiliaræ*, are probably Glands for the Secretion of some Humour from the Blood,

imported by the Arteries, which Humour is afterwards conducted by their small Veins to the emulgent Vein, and there mixed with the Blood.

The Parts which purge the Blood of the superfluous Serum, called Urine, are of three Sorts, *viz.* the *Kidneys*, the *Ureter*, and the *Bladder*. The first make a Secretion of the Serum; the second convey it to the *Bladder* as soon as it is separated; and the *Bladder* serves for a Cistern, where it is kept for some Time, and evacuated when it swells to a sufficient Quantity.

The *KIDNEYS* are called *Renes*, from *Pṛv*, to flow, because the Urine flows incessantly into the *Pelvis*.—They are seated in the Region of the Loins under the *Psoas* Muscle, upon the Sides of the *Aorta*, and *Vena Cava*, without the *Peritonæum*, one on the Right Side under the Liver, and the other on the Left under the Spleen, at the Distance of about four Fingers Breadth one from the other.

They are fastened to the *Vena Cava*, and the great Artery by the emulgent Arteries and Veins, and to the *Bladder* by the *Ureter*; the Right *Kidney* is knit to the Intestine *Cæcum*, and sometimes to the Liver; the Left one is tied to the *Colon*, and sometimes to the Spleen.—Their Figure resembles that of a Half-Moon or a Bean; that Side which faces the Vessels is concave, the opposite Side is *convex*. Commonly they are four or five Fingers breadth long, three broad and two thick.—Their Surface is smooth and soft, like that of the Liver, and their natural Colour a dark Red.

The *Kidneys* have a proper and very thin Membrane, which keeps all their Glands in their natural Order, which Membrane some imagine to be nothing else but a Continuation of the Tunicle of the Vessels inserted in the *Kidneys*, which by dilating themselves line their Inside; and then turning back upon the Outside cover that too.—They are covered, besides, with the *Peritonæum*, and always with a great deal of Fat.

Each of them receives two Nerves, one from the stomachic Branch, which spreads itself along the Membrane; and one other from the Neighbourhood of the *Mesentery*, which enters the concave Part of the *Kidneys*, and is lost in its Substance; these Nerves occasion the Vomiting in the Nephretick Pains.—The Trunk of the *Aorta* sends out two large Vessels to the *Kidneys*, which, before they enter, divide themselves into three or four Branches, and which passing through the Substance of the *Kidney*, by its concave Part, are lost in an Infinity of little Glands, to which they convey the Blood and its Serum, promiscuously mixed.

The Blood imported by the Arteries to the Glands, which cannot pass through the Orifices of these small Pipes, is taken up by the Branches of the emulgent Vein, which conducts it to the *Vena Cava*.

The *Pelvis*, or *Bason*, is a Cavity made of the upper End of the *Ureters*, in the Form of a Funnel, the narrow Part thereof marches out of the *Kidney*, and makes the Beginning of the *Ureter*.—Its Office is to receive the Urine that distils from the Nipples, which are small mamillary Bodies, shooting out a little to a Point where they are perforated, in Order to let the Urine fall into the *Bason*, and to which repair the Arteries distributed through the whole Circumference of the *Kidneys*.

The *URETERS*, (SS) are two Canals of a peculiar Form, which spring upon each Side from the *Pelvis* of the *Kidneys*, are covered with the *Peritonæum*, and terminate in the *Bladder* not far from its Neck.—They are furnished with annular Fibres, to enable them to contract themselves, and thereby facilitate the Course of the Urine into the *Bladder*.—Their Length is equal to the Interval between the *Kidney* and the *Bladder*; they are no bigger than a Writing Pen, except in the Nephretick, when their Cavities are sometimes so dilated as to receive one's little Finger, and resemble an S.—They receive Nerves from the intercostal Branch, which occasion their ex-

quisite Sense in the Gravel, and Arteries from the neighbouring Parts, and return 'em small Veins.

The *Ureters* proceed from the *Kidneys*, beginning at the End of the *Pelvis*, and terminating in the *Bladder*, which they perforate very artificially, for having pierced through the outer Membrane, they run for two Fingers breadth between the two Membranes, and then perforate the inner one near the Neck of the *Bladder*. By this Contrivance the Urine having once entered the *Bladder* cannot return back, the Orifice of one Membrane being stopped by the other.—The *Ureters* receive the Urine from the *Pelvis* and convey it to the *Bladder*.

The *BLADDER* (T) is a membranous Part, which forms a considerable Cavity, fit to contain the Urine and the solid Bodies that are preternaturally bred in it, such as Stones, &c.

The *Bladder* is situated in the *Pelvis* of the *Abdomen*; in Men immediately on the *Rectum*; in Women on the *Vagina Uteri*; its Figure in Quadrupeds resembles a Pear with the Basis upwards; but in human Bodies the lower Part is almost on a Level with the upper; and its Orifice, or Neck, placed sideways, while the *Fundus*, (V) or Bottom, which in a human *Bladder* is very broad, rests either on the *Rectum* or the *Vagina Uteri*.—It is fastened to the Navel by the *Urachus*, degenerated into a Ligament; its Sides to the umbilical Arteries, and its Neck to the *Intestinum Rectum* in Women.

The *Bladder* is composed of three Coats; the first a Covering of the *Peritonæum*; the second consists of muscular Fibres, which run irregular several Ways; and the third, which is full of Wrinkles for facilitating its Dilatation, is both glandulous and nervous.—Its Glands separate a viscous and slimy Matter, which defends the *Bladder* from the Acrimony of the Salts in the Urine.—Around its Neck there goes a small Muscle, called *Sphincter Vesicæ*, which contracts the Orifice of the *Bladder*, to prevent the Urine from dripping involuntarily, or 'till it thrusts open the Passage by the Contraction of the second Coat of the *Bladder*, called, therefore, *Detrusor Urinæ*.

Having already considered all the Parts of the *Abdomen*, which contribute to the Perfection of the Blood, it will not be improper to consider in this Place the *Aorta*, or great Artery, and the *Vena Cava*, which are two large Vessels of the *Abdomen*.

The *AORTA*, or great Artery, (Y) rises directly out of the left Ventricle of the Heart, where it receives the Blood, in order to disperse it all over the Body.—We'll only examine in this Place the Arteries it sends to the *Abdomen* after its Perforation of the Diaphragm, which are seven.—The first is the *Celiacæ*, which splits into two Branches, one on the Right Side for the Liver, and the other on the Left for the Spleen.—The second is the upper *Mesenterick*, which visits the upper Part of the *Mesentery*.—The third are the *Emulgents*, which run to the *Kidneys*.—The fourth, the *Spermaticks*, which repair to the Parts calculated for Generation.—The fifth, the lower *Mesenterick*, which goes to the Intestines and the lower Part of the *Mesentery*.—The sixth, the *Lumbares*, which serve the Muscles of the Loins.—And the seventh, the upper *Musculares*, which are lost in the Flesh.

When the *Aorta* reaches the *Os Sacrum*, it gets over the *Vena Cava*, and divides itself into two large Arteries, called the *Iliacæ*. Each Side has one of them, which subdivides itself into the internal and external.—The internal iliack Artery detaches four other Arteries, *viz.* the *Sacra*, *Muscularis*, *Inferior*, the *Umbilicalis*, and the *Hypogastrick*. The external Iliack, which is the larger of the two, sends out the *Epigastrick* and the *Pudenda*, and then marches to the Thighs, where it changes its Name, and assumes that of *Arteria Cruralis*.

Where the *Iliac* Artery terminates, there's a Vein of the same Size, called the *Iliaca Externa*, which receives not only three other small Veins, called *Muscularis inferior*, *Pudenda*, and *Epigastrica*; but also the internal Iliac Branch, consisting of two Veins, *viz.* the

the *Hypogastrica*, and the *Muscularis Media*.—These two Iliack Veins upon one Side, and the other two on the opposite, begin about the *Os Sacrum* to form a very large Vein, called the ascending *Vena Cava*, further enlarged by the Accession of the *Sacra*, and *Muscularis Superior*.

I call it *Ascendens*, since its Office is to convey the Blood from the inferior Parts to the Heart.—It begins to assume the Name of *Vena Cava* upon the *Os Sacrum*, where the four *Iliacæ* join. As it rises higher 'tis joined by four Sorts of Veins, viz. the *Lumbares*, which come from the Muscles of the Loins; the *Spermatica*, springing from the Instruments of Generation; the Emulgents from the Kidneys; and the *Adiposa* from the *Membrana Adiposa* of the Reins. This done, the *Vena Cava Ascendens* strikes through the Diaphragm into the Breast, and terminates in the right Ventricle of the Heart.

The last Parts to be considered in the *Abdomen*, are those calculated for Generation, which Nature has formed to perpetuate itself, by producing new Creatures to supply the Room of those who are gone; and to the End that Man might be excited to the Production of his own Image, that prudent Mother of all created Beings has given to those Parts such a quick, tender Sense and transporting Titillation, that often without consulting his Reason he courts Satisfaction; and indeed it is oftener the Prospect of Pleasure, than the Desire of eternizing ones-self that inflames the Imagination, so as to raise a furious Passion for Embraces.

The Organs for Generation are either common or proper; the Common are met with in both Sexes, such as are the spermatick Vessels, the Testicles, and the *Vasa Deferentia*. The proper Parts are peculiar either to a Man, as the *Parastata*, the seminal Vesicles, the Prostates, and the Yard or *Penis*; or the Womb to a Woman.

We must consider first the Parts of a Man, not only those peculiar to his Sex, but likewise those which are common to both Sexes, that we may observe wherein they differ.

The Parts of a Man which fall first under our Consideration, are the spermatick Vessels, which are four in Number, viz. two Arteries, and two Veins.—The two spermatick (AA) Arteries spring from the Trunk of the *Aorta*, run obliquely upon the *Ureters*, and along the Muscle *Psoas*, 'till they arrive at the Groin, where they are received by a Production of the *Peritonæum*, and so conducted to the Testicles, by passing through the Rings of the *Aponeuroses* of the Muscles of the *Abdomen*.—The two spermatick Veins (BB) march out from the Testicles towards the *Vena Cava*; the Right runs strait to the Trunk of the *Cava*; but the Left one terminates in the emulgent Vein.—In their Progress they are joined by small Veins from the *Peritonæum*, and the neighbouring Muscles, loaded with the superfluous Blood of their Parts, in order to lodge it in the *Cava*.

The Artery in its Ascent, and the Vein in its Descent, on each Side, approach to one another, and are covered with the *Peritonæum*.—The various Branches of the Vein form in their Progress (without the Assistance of the Artery) what we call *Corpus Varicosum*, or *Pyramidal*; but the Artery descends almost in a strait Line, without dividing itself, unless it be at the Place of its Insertion, where it's split into two Branches, the least whereof terminates under the *Epididymis*, and the other in the Testicle.

The *Spermatick Vessels* are larger in Men than in Women, and in both the Arteries are always larger than the Veins.—They don't perforate the *Peritonæum*, as in Dogs, but a Production of that Membrane conducts them along, together with some Branches of the intercostal Nerves, and some from the one and twentieth Pair of the Spine, which supply the Testicles with animal Spirits, and not with the Matter of the Seed, as some have imagined, since they have not a sufficient Cavity to contain such Liquor.

The Reason why the left spermatick Vein terminates in the emulgent, and not in the *Cava*, is the spermatick Vein, in passing over the emulgent Artery, its Bulk would have hindered the Reflux of the Blood to the *Cava*.

The Preparation of the Seed is not commenced in the spermatick Vessels, as falsely supposed by the Ancients; for if the two Arteries penetrate the Substance of the Testicles, 'tis only to procure a more exact Separation of the seminal Particles that accompany the arterious Blood, since the Remains of that Blood are carried back by the Spermatick Veins to the *Vena Cava*, and the Arteries have no *Anastomoses* with the Veins, either in this Place, or any other Part of the Body.

Therefore the Use of the *Spermatick Vessels*, is to have the Blood conveyed by the Arteries, to the upper Part of each Testicle, where the seminal Particles are separated, and the Remains of the Blood carried back, by the Branches of the Veins to the *Cava*.

The TESTICLES, are so called from the Latin Word *Testes*, Witnesses; as giving Testimony of Virility; they are what we properly call *Genitalia*.—The Greeks call them *Didymi*, or Twins.—Some Men have only one, some have three, and even four; but ordinarily, they have but two.

The Testicles (DD) are soft, white Bodies of an oval Figure, and about the Size of a Pigeon's Egg: They have been thought to be of a glandulous Substance; and according to the present Doctrine of the Glands they may be allowed to be so still.

They are formed of a Convolution of divers Kinds of Vessels, particularly of the spermatick Veins and Arteries, the latter of which bring the Blood, whence the Particles of the Seed are to be secreted in the Meanders of the Testicles, and the former return it back again, after the Secretion made.

The rest of the Testicles is made up of Seed-vessels, which, indeed, are but one continued Series, or Rope intricately convoluted, and wound up, as it were, into a Bottom; but adhering so laxly, that it is easily drawn out into Length, and in Rats shaken from its close Contexture.—These seminal Vesicles terminate in the *Parastata*.

They are seated, in Men, without the *Abdomen*, at the Root of the Yard, wrapped up in five Coats, two of which are common, viz. the *Scrotum*, and the *Dartos*; and three proper, viz. the *Eritroides*, the *Elitroides*, and the *Albuginea*.

The first of the common Sort is the *Scrotum*, or Purse, composed of a scarf Skin, and a true Skin, which is here thinner and tenderer than in any other Part of the Body; 'tis soft, wrinkled, and void of Fat.—At fourteen or fifteen Years of Age, 'tis covered with Hair.—'Tis divided into the right and left Halves by a Line, or Suture, which commences at the *Anus*, passes through the *Perinæum*, and terminates in the *Glans*, or Nut.

DARTOS, is a cutaneous Muscle, consisting of a Texture of many fleshy Fibres, by Virtue whereof, the *Scrotum* contracts and furls itself.—It receives several Vessels from the *Arterie Pudendæ*, and not only covers the two Testicles, like the *Scrotum*, but runs in between them, and keeps them from grating one upon another.

The ERITROIDES (E), is the first of the proper Class; it is interlaced with fleshy Fibres, which makes it appear red; and is produced by the *Cremaster*, a Muscle which holds up the Testicles.

The ELITROIDES (F), called also *Vaginalis*, is a Dilatation of a Production of the *Peritonæum*.—Its internal Surface is even and smooth, and the external, rough and unequal, whereby it sticks very close to the *Eritroides*.

The ALBUGINEA (G), so called from its Whiteness, is the immediate Cover of the Testicles, and impresses them with a Figure answerable to its own.—It proceeds from the Coat, in which the spermatick Vessels are wrapped.

The Testicles are suspended by two Muscles, called
† *Cremastores*

Cremastores (H), or *Suspensores*, which are inserted in the *Os Pubis*, at the End of the transverse Muscle of the *Abdomen*, and surround the *Testicles* like a Membrane, which if they happen to be stronger than ordinary, move the *Testicles* of themselves, pulling them up, and letting them fall at Pleasure.

I have already given a Hint, that the Office of the *Testicles* was to secrete the Particles of the Seed from the Blood brought to them, by the spermatick Arteries, the most refined and volatile Part whereof, is strained out from the rest, by the glandulous Pith of the *Testicles*, which gives Passage only to the finest Particles, and obliges the rest to return by the Veins. — This Part of the Blood, thus filtrated, is raised to a just Degree of Perfection, by the Length of the Pipes, through which it passes. — A further Addition to its Refinement, accrues from the Windings and Turnings of these Pipes. — Nay, it is also depurated in the excretory Duct of the *Testicle*, and the *Epididymis*. — In the Passage, we call *Deferens*, 'tis perfecter than any where else; since it begins there to turn white and frothy, whereas in the *Testicles*, it was grey and fluid. — But the Features and Impression of true Seed, is owing to the animal Spirits employed in the amorous Passion, which then put the Seed in Motion, and renders it sparkling and active.

The Seed, thus prepared, is laid up in the Expansion of the *Vasa Deferentia*; and that filtrated through the *Vesicula Seminales*, remains in their Cavity; from whence it breaks out, when the Imagination is inflamed by amorous Thoughts. — 'Tis then stirred up, and rarified, in such a Manner, that it forces up the Suckers which guard the Orifices; and at the same time the *Prostrates* squirt out a fat, oily Liquor, which covers and embraces the volatile and penetrating Seed, which otherwise would evaporate and disperse. — This Liquor flows incessantly in the *Urethra*, to guard off the Acrimony, and Sting of the Urine.

The *PARASTATÆ* (LL), or *Epididymidæ*, are two tuberous, varicose Bodies, lying upon, and adhering to the upper Part of the *Testicles*, whereof they properly appear to be a Part; though different from the rest in Form and Consistence.

The *Parastatæ* consists, like the *Testicles*, of a Convolution of seminal *Tubuli*, mixed with bloody Vessels; the Difference between them lying only in this, that the *Parastatæ*, and the *Tubuli*, are united into one, the various Convolutions of which being more firmly bound together, by a strong Membrane, arising from the *Tunica Albuginea*, it feels more compact than the *Testicles*.

The Use of the *Parastatæ*, is to receive the Seed separated in the *Testicles*, and pour it into the Trunk of the *Vas deferens*, with which it is continuous.

The *VASA DEFERENTIA* (M), are white and nervous Vessels, of a round Figure, and of the Bigness of a Quill, seated partly in the *Scrotum*, and partly in the *Abdomen*. — They are rooted in the *Testicle*; from one End of which they proceed, and march upwards, in the same Process of the *Peritoneum*, that covers the spermatick Vessels. — They turn about, upon their Arrival at the upper Part of the *Pubis*, and climb over the *Uterus*; and then, approaching to one another, run under the upper Part of the Bladder, where they have a Communication with the seminal Vessels. — The two Extremities of the *Vasa deferentia*, being arrived between the Bladder and the *Rectum*, dilate themselves, and form the *Vesicula Seminales*. — They resemble a Bunch of Grapes, and their Cells, the Cavities of Pomegranate Kernels; though not separated by a Membrane, like Grapes, for their Cells communicate with one another. — Their broadest Part is about an Inch over, they have one Side thicker and larger than the other, and their Cavities are unequal, some being greater than others. — They are seated between the Bladder and *Rectum*, near the *Prostata*, and serve for a Cistern to the Seed.

From these Vesicles, proceed two small Ducts, called EJACULATORY VESSELS, because in the Heat of Action, they really throw the Seed of the Vesicles into the *Urethra*; and are of such an exquisite Sense, that they are the chief Subjects of the Pleasure that attends Ejaculation. — These Ducts are broad near the Vesicles, from whence they proceed, but dwindle as they approach the *Urethra*, which they perforate; and on its Inside, at the Place of their Entry, form a small Caruncle or Tuft, called *Verumontanum*, which is a Sort of small Valve, which keeps the Urine out of the two Ducts, in its Passage to the *Urethra*; and obliges the Seed, when squirted out, to turn towards the *Penis*, and not towards the Bladder. — This Caruncle, some Surgeons have mistaken for a Carnosity, upon the Resistance they feel in putting a Probe down the *Urethra*.

The *PROSTATÆ* (OO), are two white, spongy, glandulous Bodies, situated at the Root of the *Penis*, or just below the Neck of the Bladder, and about the Size of Walnuts.

Authors ascribe two Kinds of Substance to the *Prostata*, the one glandulous, the other spongy, or porous; which last seems nothing but a Congeries of minute Vessels, and Cells, through the Middle of which pass the *Vesicula Seminales*, without any Communication therewith.

The *Prostata* have many excretory Ducts of their own: *De Graaf* does not remember to have known them fewer than ten in the *Prostata* of Men. — Out of these issues a whitish slimy Humour, secreted in the glandular Parts of the *Prostata*, and conveyed into the Cavity of the *Urethra*.

The Use of this Humour is to line and lubricate the Cavity of the *Urethra*, and prevent it from being annoyed by the Acrimony of the Urine, in its Passage through it, and to serve as a Vehicle to the Seed, in the Time of Ejaculation.

Boerhaave thinks that this Humour may serve to nourish the Animalcula, during the first Moments after Coition. — This Humour, he adds, remains after Castration, but is not prolific.

The same Author, from the Memoirs of the French Academy, makes the *Prostata*, to consist of an Aggregate of twelve Glands, each of which terminates by its excretory Duct, in a little Bag into which it discharges its Humour. — These twelve Bags open by as many excretory Ducts, into the Cavity of the *Urethra*, so as to encompass the Exit of the *Vesicula*; whence the Seed and the Humour of the *Prostata* are the more accurately mixed.

'Tis alledged, that this Place is the ordinary Seat of a Clap, upon the Plea, that some volatile Salts fastening there, occasion Ulcers that corrode the Caruncles; and upon that, the Orifices of the heretofore mentioned Ducts, throw out their slimy Liquor, the Flux of which is sometimes never cured.

The *PENIS* (PP), which is the Instrument appointed by Nature to convey the Seed, thus prepared and elaborated, to the Womb, for the Formation of Man, is placed at the lower and external Part of the *Abdomen*, and fastened to the *Os Pubis*.

Its Body consists of the two *Corpora Cavernosa*, the *Corpus Cavernosum Urethrae*, and the *Urethra* it self.

The *Corpora Cavernosa* of the *Penis*, have two distinct Origins in the *Os Pubis*, whence they proceed, growing both in Bulk and Thickness, till they meet the *Corpus Cavernosum* of the *Urethra*, where they join; leaving an Interstice or Channel, for its Passage along them; and thus continue their Progress connected together by a membranous Body called the *Septum*, and terminating at length in the *Glans*.

The Cavernous Body of the *Urethra*, includes the *Urethra*, or urinary Passage. — Its Form, contrary to that of the other cavernous Bodies, is largest at the two Extremes, and smallest in the Middle. — That Part included between the two Origins of the cavernous Bodies of the *Penis*, Mr. *Cowper* calls the

Bulb of the Urethra: Its other Extremity being dilated, forms the *Glans*.

The *Penis* receives Arteries (QQ) from the internal iliac Branches, and umbilical Arteries, from the capillary Extremities whereof arise so many Veins, in whose Channels are Apertures, corresponding to so many Cells, which communicating with each other empty themselves into larger venous Ducts, running on the superior Surface of the *Penis*; some whereof join the Vein of the Prepuce; others make one large Trunk, called *Vena Penis*, which marching on the *Dorsum Penis* to the *Prostatæ*; there divides and enters the internal Iliac on either Side.

The *Penis* has Nerves from a Trunk, composed of a Coalescence of the Third of the *Os Sacrum*, and a Branch of the great Crural: These ascending the cavernous Bodies, expand themselves over the upper Surface thereof, and are thence distributed to all Parts of the *Penis*.

It has a great Number of lymphatick Ducts, on its Surface under the Skin, which discharge themselves into the *Glandulæ Inguinales*.

The *Penis* has two Pair of Muscles, and an odd one; the odd Muscle is called *Accelerator Urinæ*: Its upper Part, which covers the Bulb, serves to streighten the Veins passing through it, from the *Corpus Cavernosum* of the *Urethra*, and thus hinders the Reflux of the Blood in Erection, and, by repeated Contractions, drives the Blood into the Bulb towards the *Glans*.—Its Elongation serves to compress the Channel of the *Urethra*, and to force out the contained Seed, or Urine.

The first Pair of Muscles is called the *Erectores Penis* (RR). By their Action the *Penis* is sustained and drawn towards the *Pubes*; and by the Assistance of the suspensory Ligament of the *Penis*, the *Vena Penis*, is applied to the transverse Ligament of the *Offa Pubis*, and the reflux Blood hindered from passing that Way, whereby the *Corpora Cavernosa* become distended.

The last Pair of Muscles are the *Transversales Penis* (SS), which vary in various Subjects, and are sometimes wanting; their Use is to dilate that Part of the cavernous Body of the *Urethra*, to which they are fastened.

The *Penis* has also three Glands (TT), first discovered by Mr. Cowper; These all empty themselves into the *Urethra*, and from the Tenacity of the Liquor they separate, are called the *Mucous Glands*.

The whole Compages of the *Penis*, is invested with a cellulose Membrane, of admirable Texture; which, again, is covered with a firm nervous Coat; and that with a *Cuticula*, and *Cutis*; the Duplication of the *Cutis* on the *Glans* makes the *Prepuce*.

The *PREPUCE* (V), is tied to the lower Part of the *Glans*, by a Ligament, called *Frænum*.—By another Ligament, called *Suspensorium*, the *Penis* is tied to the *Offa Pubis*.

The Use of the *Penis* is for evacuating the Seed, and Urine.—Indeed Dr. Drake, from a View of its Structure, thinks it originally intended for the former only; and that the Conveyance of the Urine, was not considered by Nature, in the Mechanism of this Part.—He adds another Use, viz. An Incitement to Venery, and the Propagation of the Species.—Indeed, without such an Instrument, the Seed of the most perfect Animal could not be conveyed to the Place of Prolification. Add to this, that an Alternation of Erection, and Flaccidity is absolutely necessary; the first for the Performance of its Office; the second, for the Security of the Part.

Without an Erection, it were impossible to emit and lodge the Seed where it ought to be: And with a constant one, almost as impossible to secure the Part from Injuries, without mentioning the Want of Instigation, which would be the Consequence of constant Erection, or *Priapism*.

The Erection of the *Penis* proceeds from the Swelling up of the cavernous Bodies, which, at that Time, are filled, not only with Spirits, (as the An-

tients have imagined) but also with a considerable Quantity of arterious Blood, which is the principal Part of the Erection, the Number of the Spirits being insufficient to compass it, and which is effected Thus.

The imaginative Faculty, being struck with the Apprehension of the Pleasure, the animal Spirit is thereupon roused, and repairs with an impetuous Force, to the Nerves of the Organs of Generation, which it puffs and blows up, by mixing with the arterious Blood, imported thither by the Arteries; and upon the Mixture of these two Liquors, a Fermentation, or Ebullition ensues, which causes Erection.

The *URETHRA* (Y) is a nervous Passage reaching from the Neck of the Bladder to the End of the *Penis*, seated underneath, and between the nervous Bodies.—'Tis composed of two Membranes; the Outermost fleshy and uneven, with transverse Fibres; the inner one thin and nervous.

The *Urethra* descends from the Bladder, and passes under the Share-Bone, after which it ascends and accompanies the *Penis* to its End, where it terminates; therefore its Figure resembles an S (which should be minded by Surgeons when they probe the Bladder).—The Use of the *Urethra* is to be a common Passage to the Seed and Urine.

Having thus examined with all possible Care and Attention the Parts calculated for Generation in a Man, we must proceed to another Historical Account, far more capable of inflaming our Curiosity, and which is a distinct View of the same Organs in a Woman.

To observe the same Order I have followed in the Description of the Parts of a Man, I'll begin with the spermatick Vessels.—A Woman has four spermatick Vessels, viz. an Artery (AA) and a Vein (BB) on each Side, as 'tis in a Man.—In both the Arteries proceed, in the same Manner from the Fore-part of the *Aorta*, but have in both a different Insertion; for, in a Woman, they divide themselves half-way into two Branches, the greatest of which after several Circumvolutions marches to the Testicles; and the least to the *Matrix*, where it splits into several Twigs, some of which repair to the Sides of the *Tubæ*, and Neck of the Womb, and others to the upper Part of its Bottom.

This Ramification of the Arteries is accompanied with an equal Number of Branches of Veins, which wind up again from the Womb and the Testicles, and joining together make two considerable Veins; of which that on the Right Side terminates in the *Cava*, and that on the Left in the emulgent Vein.

These Spermatick Vessels differ from those of Men in two Points; 1. They are not so long as in Men; since the Womens Testicles, or *Ovaria*, being lodged within the *Abdomen*, whereas those of Men, hang out in the *Scrotum*, consequently the Passage from the *Aorta* to the Testicles, and from the Testicles to the *Vena Cava* must be much shorter in a Woman than in a Man.

Women have two Testicles (CC) as well as Men, but differ in their Situation, Magnitude, Figure, Connexion, Covers and Substance.—They are seated in the *Abdomen* upon the Sides of the Bottom of the Womb, at the Distance of two Fingers breadth from it, by Reason that their Commerce and Alliance with the *Matrix* requires that they should not lie at a great Distance.—They are connected to the *Uterus* by a strong Ligament, which the Antients improperly called *Vas Deferens*, (for it is not at all hollow) and in some Measure by the *Fallopian Tubes*, and the broad Ligament about the Region of the *Ilium*.—They are fastened to the *Peritonæum* by the Spermatick Vessels, by which Means they are kept suspended about the same Height with the *Fundus Uteri*.

Their Figure is semi-oval; their Surface somewhat uneven, their Size different in the different Stages of Life. At the Time of Puberty, when largest, they usually weigh a Drachm and half.

†

They

They are covered with a common Membrane from the *Peritonæum*; their Substance is whitish, composed of a Number of little thin membranous and slender Fibres, intervoven with Arteries, Veins and Nerves.

Among these Fibres and Vessels are interspersed a Number of little round Bodies, like Bladders; full of a limpid Substance, and called *Ova* or Eggs, which include the Sperm that contains the *Fœtus*.

On each Side of the *Fundus uteri* are discovered two Ducts arising from it, called *Tubæ Fallopianæ* (D) or Trumpets, in Respect of their Form; for that in their Rise or Opening into the Womb, they are exceeding small, but in their Progress towards the *Ovary* they grow much bigger, and at length are capable to receive the Finger; from whence they contract again, and at the Extremity next the Ovaries are expanded into a Sort of Flanch or Foliage, fringed round with innumerate little Fibres, bearing some Resemblance to the Flanch of a Trumpet.

The FALLOPIAN TUBES are four or five Inches long; they consist of a double Membrane, derived from the outer and inner Membrane of the *Uterus*.—The Extremity next the *Ovary*, at the Time of Impregnation, at which Time the whole Tube is expanded, reaches to, and embraces the *Ovary*; tho', at other Times, it seems to fall a little short of it, and is only slightly tied by the Fringe to the under Side of the *Ovary*.

The Use of the *Tubes* is to convey the *Seed*, or rather *Ova* of Women, from the Testicles, or Ovaries into the *Uterus* or *Womb*.

Their inner Substance is composed, in good Measure, of Ramifications of Veins and Arteries, which form a Kind of reticular or cavernous Body, not unlike that of the *Clitoris*. This Structure makes them capable of Dilatation and Contraction, according to the Quantity and Stop of the Blood; and consequently of being, as it were, erected in *Coitu*, and of embracing the *Ovary* at that Time, which in their State of Flaccidity they did not.

They take their Denomination *Fallopian* from *Gabriel Fallopius*, a *Modenese*, who died in 1562, commonly reputed their first Inventor, though we find them described long before in *Rufus* of *Ephesus*.

The *Ova*, or *Embryos*, are sometimes detained in the *Tubæ Fallopianæ*, and cannot make their Way into the Womb.—*Abraham Cyprianus*, a celebrated Physician of *Amsterdam*, in a Letter to Sir *Thomas Millington*, describes the Manner in which he drew a *Fœtus* twenty-one Months old out of the *Tubæ* of a living Woman, who lived and had several Children after the Operation.

TWINS spring always from two Eggs disengaged from the *Ovarium* at one and the same time. The Egg has two Membranes strew'd with Vessels, which at first are very small and fine, but grows larger after it has been fecundated by the more volatile Part of the *Seed* of Man carried to the *Ovarium*, through the *Tubæ Fallopianæ*.

The MATRIX (E) *Uterus*, or *Womb*, is the principal Organ of Generation. 'Tis placed in the lower Part of the *Hypogastrium*, between the *Rectum* and the Bladder; lodged in a Cavity called *Pelvis*, so large as to give the Womb Liberty to distend itself upon Impregnation. It is surrounded and defended by mighty Bones; before by the *Os Pubis*, behind by the *Sacrum*, on each side by the *Ilium* and *Ischium*. It is in Figure somewhat like a flat Flask, or dried Pear. In Women with Child, it expands and receives different Forms, according to the different Times and Circumstances of Gestation.—It has several Coats, Arteries, Veins, Nerves, and Ligaments, and is interwoven with several Kind of Fibres.

Anatomists divide the *Matrix* into the *Fundus* and *Cervix*; a broad Part, and a Neck.—It is in Extent from the Extremity of the one to that of the other, about three Inches in Length; its Breadth at the *Fundus* is about two and a half, and its Thickness two.—It has but one Cavity, unless we distinguish between the Cavity of the *Uterus*, and that of

its Neck. That of the *Cervix* is very small, scarce sufficient to contain a Garden Bean. At the Bottom or Neck towards the *Fundus*, it grows very narrow in Virgins; the Extremity of it is called the *Osculum Internum*; in pregnant Women it opens, more especially towards the Time of Delivery.—The other and lower Orifice of the Neck towards the *Vagina*, called *Osculum Externum*, is a little prominent, resembling, in some measure, the Glans of the virile Organ.

The Substance of the *Matrix* is membraneous; which enables it to receive the *Seed*; to stretch and spread itself for the growth of the Child; to contract itself for the Egress of the Child, and After-birth, and at last to reinstate itself in its natural Posture.

The *Matrix* is tied fast at the Bottom and at the Neck. The Neck which is covered with the *Peritonæum*, is knit before to the Bladder and the Share-Bone, and behind to the *Rectum* and the *Os Sacrum*; the Bottom is more at Liberty in order to move, dilate, and contract itself upon Occasion, though equipped with four Ligaments, two upper ones (FF), which are nothing else but the Productions of the *Peritonæum*, which proceed from the Loins, and are inserted in the Sides of the Bottom of the Womb, to prevent its falling down upon the Neck; and two Inferiors (GG) which rise from the Sides of the Bottom of the Womb, towards its Horns, and passing through the Reins in the *Aponeuroses*, or Tendons of the Muscles of the *Abdomen*, march to the Groins, where they divide themselves into several Branches, some of which are inserted into the Share-Bone, and others in the Thighs, from whence proceed the Pains which pregnant Women feel in those Parts, which increase as the Belly rises.

From the Nerves dispersed over the Bottom of the Womb, as well as its Neck, and which proceed some from the intercostal Branch, and some from those that pass through the *Os Sacrum*, the *Matrix* receives its exquisite Sense of Pain, or Pleasure; and are the Occasion of its Sympathy with all the Parts of the Body.

The Womb is sprinkled all over with Blood imported, part by the spermatick Arteries, we have mentioned above, and part by other Arteries, which spring from the hypogastrick ones.

These Arteries not only furnish the Womb with Blood for its Nourishment, but likewise pour in Blood through an Infinity of small Branches upon the whole Body of the *Placenta*, in order to be sent through the Navel-String to the *Fœtus*.—When a Woman is not with Child, the same Blood slips away through several Passages that open into the Circumference of the Bottom of the Womb, and falls into its Cavity, from whence it makes its Exit through the *Vagina* every Month; and this is what we call menstrual Blood.

There are some of these Arteries that supply the inner Orifice with Blood, which is sometimes let out in pregnant Women, especially when the Person has more than is necessary for the Nourishment of the Child; so that we must not be surprized upon seeing some Women visited by their *Terms* several Times during their being with Child, who nevertheless go their full Time; since in that case the Flux comes from the Vessels of the Neck of the Womb, and not from the Bottom, for if from the Bottom it would occasion a Miscarriage, but no otherwise.

The Hypogastrick and Spermatick are the two principal Veins of the *Matrix*, which consists of an Infinity of Branches, springing from all the Parts of the Womb, and exporting the Blood to the Trunk of the *Vena Cava*.

Since we have already compared the *Matrix* to a Flask, we must believe that it has a Bottom, a Neck, and Orifices, and in Fact it has two Orifices, the one internal, and the other external.

The external Orifice (H) called *Pudendum*, is composed of several Parts, some of which are obvi-

ous, as the *Pubes*, the *Mons Veneris*, the Lips, and the great Slit; but the others are only descry'd after the Deduction of the Lips, such are the *Nymphæ*, the *Clitoris*, *Urinary Passage*, and the *Caruncles*.

The *PUBES* (I) is seated on the Forepart of the *Share-Bone*, and immediately above the *Pudendum*. It consists of Fat, which serves as a little Cushion to hinder the Hardness of the Bones from being hurtful in the amorous Embraces.

MONS VENERIS (K) is seated a little lower than the *Pubes*, above the great Lips, and at fourteen Years of Age, begins to be covered as well as the *Pubes* with little Hairs, which serve to prevent the grating of the Man's Parts against the Woman's in time of Action.

The great *LABIA* (LL) descend from this Hill, one on the right and the other on the left, and meet in the *Perineum*.—They consist of the Skin doubled, and spongy Flesh and Fat, which renders them pretty thick.—In Girls they are firmer than in those who have received Man, and in those who have bore many Children they are soft and flabby.—The Space between the two Lips is called the great Cleft, or Chink, and reaches from the *Mons Veneris* to the *Perineum*.

Upon spreading the Thighs, and drawing aside the *Two Lips*, we find two fleshy soft and spongy Excrescences, and called

NYMPHÆ (MM) which descend from the Tip of the *Clitoris* to the Sides of the Urinary Passage; thus reaching to about the Middle of the Orifice of the *Vagina*, where they grow less and less till they disappear.

Their Breadth is uncertain, usually in Maids half a Finger; some times they are larger, and capable of being distended to a great Degree; so as to hang a good Way out of the Body, and in such Cases are often extirpated.

The Use of the *Nymphæ* is, by swelling in Act of Coition, to embrace the *Penis*, and by their Sensibility to affect the Woman, and mutually invite to Procreation.

Their Substance is very spongy, composed of Membranes, and Vessels loosely cohering, and therefore easily distensible.

Within the great Cleft above the *Nymphæ*, there is a long round and glandulous Body, which encreases towards the Extremity, called *CLITORIS*.

Some call the *Clitoris* (NN) *Ostrum Veneris*, from its exquisite Sensation, for all *Physicians* as well as *Anatomists* agree in this, that the *Clitoris* is the principal Seat of Pleasure, and some of them believe that Women of a wanton Constitution procure to themselves, by the Friction of this Part, a Pleasure that supplies the Room of a Man's Embraces.

Its Appearance commences in Virgins about the fourteenth Year of their Age; after which it enlarges as the Years advance, or in proportion to the greater or lesser Salaciousness of the Person.—In the Ardour of Enjoyment it swells and becomes hard, just as the Yard swells in the Time of Erection, and by the same Cause.—In some Women 'tis very large, and shoots without the Lips; in others it has the Size of a Man's Yard, and serves for an Instrument to abuse other Women, as in the *Hermaprodites*.

The *Clitoris* is composed of the same Parts with those of the *Penis*; it has, like it, two cavernous or spongy Bodies, and a *Glans* (O) at the Extremity covered with a *Preputium* (P), but not perforated like the *Penis*.

It has two Muscles (RR) which erect it in Coition, on which occasion it swells and grows hard.

The spongy Bodies of the *Clitoris*, arise distinctly from the lower Part of the *Os Pubis*, and approaching one another unite, and form the Body of the *Clitoris*; before their Union they are called *Crura Clitoridis*, and are twice as long as the Body of the *Clitoris*.

Its Muscles arise from the Protuberance of the

Ischium, and are inserted into its spongy Bodies; it has Veins and Arteries from the hemorrhoidal Vessels and *Pudenda*; and Nerves from the intercostal, which serve not only to raise and stiffen the *Clitoris*, but likewise to contract and straiten the Orifice of the *Vagina*; for when they swell themselves, they oblige the *Labia* to draw close to one another; by which Means the Yard is extremely squeezed in the amorous Approaches.—'Tis also by virtue of these Muscles that some Women move the *Labia* at pleasure.

The *Arteriæ Pudendæ* furnish the *Clitoris* with Blood, and the *Venæ Pudendæ* carry it back into the *Cava*.

Under the *Clitoris* appears the Urinary Passage, surrounded with a *Sphincter*, which serves to imprison or release the Urine at pleasure, and this Passage being larger and shorter in Women than in Men, their Urine being thereby provided with more Dispatch, sweeps off the small Stones, Sand, and Gravel, which oftentimes remain in the Bottom of a Man's Bladder, so that Women are less subject to the Stone.

Graaf calls *Lacina* a glandulous Body, of about a Finger's Breadth thick, situated between the fleshy Fibres of the *Uretbra*, and the Membrane of the *Vagina*, and which spreads itself along and round the Bladder.—Those Conducts terminate in the lower Part of the *Vulva*, and there throw out a slimy Matter that mixes with the Male Seed.

The *CARUNCLES MYRTIFORMES* (VVVV) come next; placed, as it were, in the four Corners of a Quadrangle, and in the midst of a long Cavity called *Fossa Navicularis*.—They are made of the fleshy Wrinkles of the *Vagina*, which render the Passage so much the straiter, especially in Virgins, in whom they are joined side-ways to one another by some small Membranes, which make them resemble a Rose-bud half blown; but when those Membranes are once broken, by the Ingress of the *Penis*, or the Egress of a Child, they are separated, and never rejoin.—These *Caruncles* serve for two Uses, one is to heighten the mutual Pleasure of Enjoyment, by clinging round and locking up the Yard; the other is to facilitate the Egress of the Child, by extending themselves.

I am of Opinion that the Union of these two *Caruncles*, is the sole Mark of Virginity in a Woman, and that the Pains felt in the first Embraces, and the spilling some Drops of Blood proceed from the forcing of a Passage through these *Caruncles*, and lacerating the little Membranes that unite them, and not from the Renting of a certain imaginary Membrane called *HYMEN*, by some *Anatomists*, but which none of them could ever yet discover; therefore, we must not suppose that the trifling Pains felt in the first Adventure, and the few Drops of Blood spilt, are always a certain Evidence of getting a Maidenhead, since that pretended *Hymen*, supposed to obstruct the Entrance of the *Vagina*, is but a Fiction, and the *Caruncule Myrtiformes*, are some times ranged in such a manner, that the Yard may enter without Violence.

Having thus carefully examined the Parts calculated for Generation, both in Men and Women; it will not be improper to give here, some account of the Generation itself.

To proceed with some Order in this curious Discovery, we must consider, that an Animal cannot be produced without a Couple, *i. e.* a Male and a Female, each of which acts its respective Part in the admirable Work of Generation. Let us therefore inquire first into the Man's Part.

The whole of his Action may be reduced to two Heads, *viz.* the producing of Seed, and the conveying it into the Womb,

The Seed, *Semen*, is a white Liquid Matter, the Thickest of any in the Body, separated from the Blood in the Testicles, and reserved in proper Vessels to be the Means of Generation.

The

The Parts concerned in the Preparation of the *Seed* are the spermatick Arteries, which bring the Blood to be secreted into the Testicles; the Testicles and *Parastatae*, where the Secretion is chiefly effected; the *Vasa Deferentia*, which convey the secreted Matter out of the Testicles; and the *Vesiculæ Seminales*, which receive and preserve it to be emitted in Coition.

Some admit of four several Kinds of *Seed*; the *Seed* of the Testicles, that of the *Vesiculæ Seminales*, that of the *Prostates*, and that of the Glands of the *Penis*; though the Liquor of the *Prostates*, and that of the Glands of the *Penis*, are generally allowed not to be any true *Seed*, no more than that emitted by Women; nor is there any good Reason why either of them should be called so, as their Appearance is very different, and as other sufficient Uses are assigned for them, *viz.* to line and lubricate the Parts, that the *Seed*, Urine, &c. may pass more freely, and without adhering.

The seminal Liquor however, such as emitted for Use, is a Mixture of several Fluids, poured at the same Time into the common Canal of the *Urethra*, either from the Glands that have secreted them, or the Reservoirs that have kept them.

Mr. *Du Verney* observes, that in different Species, the Number and Structure of these Organs is different.—In Man the principal are the *Vesiculæ Seminales* and *Prostates*, besides what was discovered by Mr. *Cowper*, *viz.* a Number of new glandulous Bodies on each side the *Urethra*, towards the Root of the *Yard*.—Mr. *Du Verney* has found that the same are likewise in most other Animals, and placed in the same manner.

It is controverted, whether or no the Liquor filtrated hereby, be necessary for Generation. Mr. *Du Verney* thinks it is, and his chief Reason is, that in Animals that have been castrated, these Glands, as well as all the other Sources of Generation, are found dried up and decayed.—Mr. *Littre* objects to this, that the *Vesiculæ Seminales* and *Prostates* having little Cells where their filtrated Liquor is deposited, it is easily conceived, that their Humours may wait some time for an Occasion of being emitted; but that these new *Prostates* or Glands of Mr. *Cowper* having no such Reservoirs, their Liquor must come out into the Cavity of the *Urethra*, in proportion as it is separated, and be destined for some continual, a momentary, or occasional Use.

I will not amuse myself here to enter into a strict Examen of the different Opinions on the Nature of the *Seed*; if it is prepared by the Concoction or Conversion of Blood into it; or if it is a Juice imported by the Nerves to the Organs of Generation; or if the *Seed* is composed of an Infinity of little Animals, called *Seminary*, which late Opinion has been much in Vogue for several Years past, and has set the two celebrated Faculties of *Paris* and of *Montpelier* at Variance.

Mr. *Leeuwenhoek* was the first Discoverer of these *Animalculæ*, and many after him make no Scruple to call them true *Fœtus's*, little Men; and some have even pretended to discover somewhat of the human Figure therein.—But *Verheyen*, and others after him deny the Existence of any such *Animalculæ*; maintaining that it is only the intestine Motion of the Parts of the *Seed*, kept on Foot by the Warmth thereof, that exhibits this Appearance, which fanciful Persons have improved into frisking *Animalculæ*; and urging in Confirmation hereof, that no sooner is the Warmth gone than all the Appearance of Animals ceases.

Mr. *Heartsoeker* published his *Dioptrical Essay* in the 31st *Journal des Sçavans*, for the Year 1678, wherein he pretends to have examined the *Seed* of Animals with a Microscope, and discovered that 'tis full of an Infinity of other Animals.—That in Man these seminal Animals are so many *Seeds* of other Men, which being conveyed to the *Ovarium*, strike at the first Egg they meet with; upon which one of them perforates the Membrane, or gets into the Egg by a

supposed Artifice, and presently shuts itself up, leaving the rest to perish without Doors, unless some of them be so lucky as to slip into another Egg. The Animal that enters the Egg serves for *Sperm*, which by swelling it up prompts it to disengage itself from the *Ovarium*, and tumble into the *Tuba*, which conducts it to the Womb.

I must confess that this Discovery, if true, is a very curious one, but I'll rather follow my first Notion, which is, that the several seminal Particles being separated from the Blood by the natural Disposition of the Testicles, are received by an infinite Number of the small Roots of the *Epididymes*, which convey them to these glandulous Bodies; from whence they repair to the *Vasa Deferentia*, and are by them conducted by Drops to the seminal Vesicles.—In these Vesicles all these Particles being joined make a prolifick Liquor, called *Seed*, laid up for a Reserve in these little Bags.

All the Care that Nature takes in raising this Liquor to a due Degree of Perfection, would prove of no Use if it continued always in the Cisterns. It must have an Egress, and be transferred to a Place that's qualified for the Production of Man. This Place is the Womb; and the Action which transfers the *Seed* is called Copulation, to which, a Man, when arrived at a certain Period of Years, is inclinable of his own Accord, without being egg'd up to it, or instructed in the Way of going about it.

COPULATION is the joining of a Male to a Female; in the Action the Male gives, and the Female receives; but there are three necessary Circumstances in performing the Act of Copulation; the first is the Erection of the *Yard*; the second its being lodged in the Neck of the Womb; and the third is the Ejaculation of the *Seed*.

The Erection of the *Penis*, consists in a Distention of its *Corpora Cavernosa*, by an extraordinary Quantity of Blood pent up therein; and which is effected in the following Manner.

The Fancy being warmed with the Idea of Pleasure, the animal Juice falls out, and repairs with Expedition to the Nerves of the Genitals, where it throws itself into the Cavernous Bodies, and mixes with the arterious Blood then lodged in the same Bodies; upon which ensues the Ebullition of the two Liquors, and consequently an Erection.

The only Use of the Erection is to enable the *Yard* to enter the Neck of the Womb, and squirt in the *Seed* upon it.—Sometimes the Erection is so strong, that the *Yard* is always bent, as in a *Priapism*, or a *Satyriasis*, but that Sort of Erection is not proper for Generation.—A large *Yard* does not stand so readily as a small one; and when it does, it cannot hold so long, because it requires more Blood to fill it; and when 'tis full it is heavier, and consequently apt to fall in a very short Time.

Nature has taught all Animals (and Man among the Rest) the most convenient Posture for Copulation, and every one is acquainted with the Measures of Decency that Reason enjoins; I shall therefore pass over this Head in Silence, and only now observe to you, that the Business of Generation suffers no Alteration from the Shortness or Length of the *Yard* within the Neck of the Womb; for the Action of the two round Ligaments consists in making the Bottom of the Womb to approach the Head of the *Yard*, in order to receive the *Seed* in Time of Ejaculation.

THE EJACULATION, which ought to follow the Lodging of the *Yard* in the Neck of the Womb, is thus performed.—The *Seed* taking Leave of the Seminal Vesicles, passes through the ejaculatory Vessels, and enters the *Urethra*, from whence 'tis squirted out with a Jirk, by Virtue of the Convulsions that then seize the *Yard*.—This Emission is performed more nimbly in some than others, occasioned by this, that some are keener than others, or that their seminal Vesicles are fuller of *Seed*.—The Quantity of *Seed* thus emitted cannot be determined; some squirt out more than others; and no more is necessary.

cessary than what can keep up its Conveyance to the *Ovarium*.——The principal Pleasure aimed at by the Animal, at that Time, is confined to that critical Moment of *Ejaculation*; which tickling Pleasure springs from the Spirits mixed with the Seed; for these being pliant and moveable Particles, they tickle and lightly graze up and down in the Parts, rather than pierce and gall them. The Fineness and Bending of the nervous Fibres of the Parts contributes likewise towards the quick Sense of Pleasure.

Of all Temperaments the Sanguine are most amorous.——The Blood of bilious Constitutions is too sharp and subtile; that of Melancholick too heavy and too watery to produce laudable *Seed*; but the Blood of a sanguine Complexion is possessed of the due Softness, Warmth, and Consistency that enables it to furnish Abundance of laudable *Seed*.

We'll now take a View of the Woman's Part in the Act of *Generation*; but before we proceed further we must make some Remarks upon the Testicles of Women. 1. That the Testicles of Women are Glands which filtrate the Seed; and that each of them has an excretory Vessel, which conveys the filtrated Seed to the Vesicles. 2. That in Women each of these Vesicles is separated from its neighbouring Vesicle, as one Grape is from another in the same Bunch. 3. That in each Vesicle there is a Seed which is capable to form a Child, just as a Hen-Egg contains all the necessary Particles for producing a Chick; and, 4. That each Vesicle may disengage itself from the Testicle, and be transported to the Bottom of the Womb.—Upon this Principle we call the Vesicles Eggs, and change the Name of Testicles into that of *Ovarium*.

It is a common Opinion that Women have some Advantage from their Testicles being placed within, as that of receiving of more Pleasure than Men, in the amorous Embraces; but I am apt to believe that the Evils it occasions outvye the Pleasure; for the Seed being retained there turns sharp and sour, and causes those cruel Vapours, to which they are subject.——We see by Experience that most Girls arriving at the Age in which the Secretion of the Seed is performed in the Testicles, turn Yellow and Pale, and are never cured of that Illness till they marry. Now this proceeds from the Seed turned Sour by its long Abode, which mixing with the Blood breaks its Texture, and changes its Consistence; so that by rendring it more serous, liquid, and cold, and by flattening its Redness, it makes the Colour of the Skin less lively.——'Tis very probable that most of the Nuns and other Girls that are taken to be possessed with Devils, were subject to Vapours when they acted the awkward Extravagances History is full of.—Men themselves are disordered by Seed; for we find that those especially, who live in Continence, are attacked with Vapours which incommode them very much.

The *MATRIX*, or Womb, is the proper and peculiar Organ of Generation. 'Tis certain that the *Fœtus* is formed within it out of the Seed that it foment; but we are at a Loss to know in what Manner it is formed.

There are two principal Theories or Methods of accounting for the Generation of Animals: The one supposes the *Embryo* or *Fœtus* to be originally in the Seed of the Male; the other in the *Ovum* or Egg of the Female.

The *First* supposes Animalcules in the male Seed (as I have already observed) to be the first Rudiments of the *Fœtus*; and that the Female only furnishes a proper *Nidus* and Nutriment to bring them forwards.

The *Second* supposes the first Rudiments of the Animal to be in the *Ova*; and that the Male-Seed only serves to warm, cherish, and ripen the *Ova*, 'till they fall off out of the *Ovary* into the Womb; which is chiefly supported (say the Retainers to that System) from the Conformation in Rabbits, Cows, &c. where the *Vagina* of the Womb is so long and sinous, that it is scarce possible the Male-Seed should ever arrive

within the Body of the *Uterus*, especially in Cows, whose *Vagina* is filled with a thick, viscid Ichor, and the inner Orifice of the Womb exactly closed.——They add to this that it is highly improbable that the Animalcules (mentioned by Mr. *Leeuwenhoeck* and others) should contain the Rudiments of a future Body; since their large Number would produce too plentiful an Offspring; in so much that it would be necessary for 9999 Parts of them to be in vain and perish, which is contrary to the *Œconomy* of Nature in other Things.

Analogy is likewise urged in Favour of this System: That all Plants are maintained to arise from Eggs; Seeds being no other than Eggs under another Denomination. All *oviparous* Animals do unexceptionably arise from Eggs; which the Female casts forth; and it is highly probable, that the Females lay and hatch their Eggs within themselves.

Against this Hypothesis it is urged, that what are usually called *Ova*, or Eggs, in Women, are no other than little Cells or Bladders, full of a certain Liquor: And how can a Drop of Liquor pass for an Egg? And that these imaginary Eggs have no proper Membrane belonging to them, nor any Covering but that of the Cell; which seems so inseparable therefrom, that when they are discharged, it is hard to conceive how they should take it with them. And beside, how should they make themselves a Passage through the common Membrane, wherewith the *Ovary* is invested, which is of so close a Texture, that it must seem absolutely impenetrable, by a round Body of so soft a Consistence, as one of these Vesicles.——Lastly, *Vesiculae*, in all Respects perfectly like *Ova*, have been found in other Parts of the Body, where it is apparent they could not serve for any Purposes of Generation. *Mem. de l'Academ. Royal des Scien.* An. 1708, 1709.

To this it is answered, that *Ova*, or *Vesiculae*, have been actually found in Dissections, detached and separated from the *Ovary*, and the Ruptures in the Membranes in the *Ovary*, through which they had passed, still visible.

Mr. *Littre* even observed some of these separated *Ova*, spread with blood Vessels, like those in the Yolks of Birds Eggs.——Nay more, the same Author is positive, that he saw an *Embryo* in one of the *Ova* not yet separated; could discern its Head, Mouth, Nose, Trunk, and *Funiculus umbilicalis*, whereby it adhered to the Membranes of the *Ovary*.

Sir *John Floyer* starts a Difficulty, which seems to press equally against each System, taken singly: It is fetched from Monsters; in a Mule, for Instance, which is the Production of a *venereal Copula*, between an Ass and a Mare, the Bulk of the Body partakes of the Form of the Dam; and the Feet, Tail, and Ears of that of the Sire; hence it is argued, that the Rudiments of the greater Part of the *Fœtus*, are laid in the *Ovum*; and that the Impregnation, either conveys, or changes the Extremities. If the Male supplied the *Animalcula*, the *Fœtus* should always be of the same Species as the Male: If the Female supply it, it should be of her Kind; whereas Monsters are of both.

But notwithstanding this Objection, all Anatomists agree, at present, that the *Fœtus* is certainly lodged in an Egg; and that the Process of Generation, on the Part of the Female, is thus,

The *Clitoris* being erected, after the like Manner as the *Penis* in Man; and the neighbouring Parts all distended with Blood, they more adequately embrace the *Penis* in *Coitu*; and by their Intumescence, press out a Liquor from the Glands about the Neck of the Womb, to facilitate the Passage of the *Penis*.—At the same Time the Fibres of the Womb contracting, open its Mouth, (which at other Times is extremely close) for the Reception of the finer Part of the Seed.

Thus the Seed, pregnant with *Animalculas*, is conveyed, with some Impetus, into the *Uterus*; where, being retained by the convulsive Constriction of

of the inner Membrane thereof, and further heated and agitated therein, it is prepared to impregnate the *Ovum*.

During the Act of Coition the *Fallopian Tubes* growing stiff, embrace the Ovaries with their strong musculous Edges, like Fingers, and compress them; till their Mouth being dilated, and expanded by this Embrace, force the Egg, now ripened, into their Cavities, and gradually drive it forwards, by their vermicular Motion, till at last, they protrude it into the Cavity of the Womb, to meet the Seed; some of the Animalcules whereof, entering the dilated Pores of the glandulous Membrane of the Egg, are there retained, nourished, grow to its Navel, and suffocate the rest of the less lively *Animacula*.

Thus speak the Asserters of that System.

They who set aside the *Animalcules*, as unconcerned in *Generation*, account for it thus: The Seed containing oily, volatile, and saline Parts (as appears from its fetid Smell, oleaginous Substance, &c.) being lodged in the Womb, and there further digested and exalted; grows yet more volatile, fetid, pungent, and stimulating; and thus adding to the Heat occasioned by Coition, vellicates the nervous Fibres of that Part, and occasions a Fermentation; and by that Means an extraordinary Flux of Humours to that and the adjacent Parts.

By this Means the *Tubæ* become rigid, and fit to grasp the *Ovaries*, which are also heated by the *Effluvia* of the *Semen*, and the Warmth of the Parts surrounding; till at length, some of them at least, by such greater Supply of Nourishment, increase in Bulk; and as those grasped by the Edges of the *Tubæ*, will be kept warmest, and the greatest Flux be made thereto, they will soonest be ripened, fall off, and be received by the *Tubæ*, and conveyed to the Womb; where growing after the Manner of the Seed of Plants, the *Placenta*, at length, lays hold of, and adheres to the *Uterus*; from which Time the *Embryo* begins to be nourished after a different Manner.

Here we conclude the historical Description of the Parts contained in the *Abdomen*, and proceed to the *Thorax*.

The *THORAX* (A), or *Breast*, is the whole Cavity that reaches from the *Claviculae*, or channel Bones, to the Midriff, with the *Sternum*, or Breast-Bone before, the Ribs on the Sides, and the *Vertebrae* of the Back behind.—Its Figure is almost oval; 'tis flat behind, and broad and arched before.—Its Magnitude is not always the same, but generally speaking, it ought to be rather larger than lesser, for the easy Expansion, and Motion of the Lungs.—Its Substance is partly bony, and partly fleshy.

The *Thorax* or Breast, is divided, like the *Abdomen*, into containing and contained Parts. The containing Parts are either common or proper; the common are those I spoke of under the Head of the *Abdomen*, with this Difference, that the Skin is covered with Hair always under the Arm-pits, and sometimes upon the Breasts; and that the Fat of the *Thorax*, (abating for the Breasts) is but in a small Quantity.

The Proper, containing Parts of the *Thorax*, are ranked in four Classes; some are glandulous, as the Breasts, in both Sexes; some cartilaginous or bony, as the Breast-bone, the Ribs, the Channel-Bone, the Shoulder-blades, and the *Vertebrae* of the Back. Some fleshy, as the Pectoral, Intercostal, and other Muscles; and some Membranous, as the *Pleura*, and the *Mediastinum*.

The Parts contained in the *Thorax* are the *Viscera*, and the Vessels.—The *Viscera*, are the Heart, with its *Pericardium*; and the Lungs, with Part of the Wind-pipe, and the Gullet.—The Vessels are several Nerves, the great Artery, the *Vena Cava*, and the Thoracick Duct.

The most apparent of the proper containing Parts, are the Breasts, *Mammæ*, a prominent, fleshy Part on the Outside of the *Thorax*, serving to separate the Milk.

The *Breasts* are much more perfect, more conspicuous, and of more Use in Women, than in Men: Their Magnitude is various; always biggest in Time of Gestation and Lactation.—Their Figure represents a large Section of a Globe, having in the Middle a Prominence, terminating in a blunt Point, called the *Papilla* or Nipple, in the Extremity of which are Perforations, to which reach lacteal Tubes.

The *PAPILLA* or *Nipple* (C), is of a fungous and spongy Substance, not unlike the Nut of the Yard, by Virtue of which it droops or raises itself, when sucked or handled.—'Tis possessed with an exquisite Sense, to the End that the Woman may perceive a sort of Pleasure from the soft Titillation that the Child makes in sucking, and for that Reason be the readier to suckle it when Occasion calls.

In Virgins the *Nipple* is red and little; but in Nurses, and those who are past Child-bearings 'tis livid and big.

For the Choice of a Nurse, we commonly prefer those who have the least *Nipples*, because a large *Nipple* hinders the Child from sucking, by over cramming his Mouth.—Some pretend that a large *Nipple* is to be avoided, because it enlarges the Child's Mouth, but that's a vulgar Error.—The *Nipple* is surrounded with a Circle called *Arcola*, of a pale Colour, in Maids, brown in pregnant Women and Nurses, and black in old Persons.

The internal Substance of the *Breasts*, is composed of a great Number of Glands of various Sizes, and an oval Figure, intermixed with Globules, and Vessels of Fat. Their excretory Ducts, as they approach the *Nipple*, join and unite together, till at last they form seven, eight, or more small Pipes, called *Tubuli Lactiferi*, which have several cross Canals, by which they communicate with one another, to obviate the Inconveniencies, that might accrue from the casual Obstruction of one or more of them.—These Tubes are not every where of equal Capacity, but in some Places more, in others less dilated; so as to form Cells, which seem contrived to hinder the spontaneous Efflux, and to create a Necessity of sucking, to fetch out the Contents.

Of the Concurrence of these *Tubuli* or Pipes, is the Substance of the *Papilla* in some Measure formed; among which is interspersed a glandulous Substance, serving to keep them from pressing too close on each other: And with it are intermixed Abundance of Fibres, derived from the external Tegument of the *Papilla*; by Means whereof, the lacteal Tubes are constricted, and the Motion of the Milk modified.

Besides these Vessels are abundance of fatty Globules called *Ductus Adiposi*, which some would have only to fill up the Interstices of the Glands; but Dr. Drake, after *Malpighi*, thinks they contribute to the Composition of the Milk.

In Virgins, the Tubes which compose the Glands of the *Breasts*, like Sphincter Muscles, contract so closely, that no Part of the Blood can enter them: But when the Womb grows big with a *Fœtus*, and compresses the descending Trunk of the great Artery, the Blood flows in greater Quantities, and with a greater Force through the Arteries of the Breasts, and forces a Passage into their Glands; which being at first narrow, admit only of a thin Water; but growing wider by Degrees, as the Womb grows bigger, the Glands receive a thicker *Serum*; and after the Birth, they run with a thick Milk; because that Blood which before flowed to the *Fœtus*, and for three or four Days afterwards, by the *Uterus*, beginning then to stop, does more dilate the mamillary Glands.

The Nerves of the *Breasts*, are derived from the fifth Pair of the *Vertebrae*, which being dispersed through the whole Substance of the Breast, terminate in the *Nipple*, and entitle it to a very tender Sense.

The *Breasts* have two Sorts of Arteries, viz. the Internal, which visit their inner Part; and External, which run along the outward Surface. The latter

are the upper *Thoracæ*, springing from the *Axillares*; and the former are the *Mammariæ*, which spring from the *Subclaviæ*, and bestow a Branch upon each of the oval Glands, which compose the Breast.

The same Glands give Rise to several Sprigs of Veins, which form the *Venæ Mammariæ*, and unload in the *Subclaviæ*.—In the like Manner the external Part of the Breast sends out several Branches, which are the Trunks of the *Thoracæ superiores*, and repair to the *Axillares*.—The outer Arteries import Blood for the Nourishment of the Breasts, and the inner ones feed all the Glands.—The Blood thus imported, is exported by the Veins, viz. the *Mammariæ*, and the *Thoracæ Superiores*; the former disembodying in the *Subclaviæ*, and the latter in the *Axillares*.

'Twas formerly the received Opinion, that the Breasts produced Milk for the Nourishment of the Child after his Birth, by turning the Blood, the Fetus had been fed with in the Womb, into Milk, by a peculiar concocting Virtue in the Glands of the Breasts, and these Glands communicating a Whiteness to the Blood by an assimilating Faculty.

But the Moderns are of Opinion, that the Milk comes from the pure Chyle, conveyed by the Arteries to the Breast, and without any other Coction filtrated through the Glands, whereof they are composed like Urine through the Reins, without undergoing any considerable Change.

According to Mr. *Leeuwenhoek's* Observations, Milk consists of little Globules, swimming in a clear, transparent Liquor, called Serum, or Whey.

MILK is a Composition of three different Kinds of Parts, butyrous, caseous, and serous.—The Butyrous Parts, are the Cream, and Oil that swims atop.—The Caseous, are the grosser Parts, and those that coagulate, and are made into Cheese.—The Serous are properly a Lympha, and make what we call Whey.

The Milk is prepared after this Manner. The Chyle being conveyed by the *Thoracick Duct*, to the *Subclavian Vein*, near the Axillary, runs from thence to the Cava; and to the right Ventricle of the Heart, where it joins in with the Blood, and accompanies it to the great Artery, which distributes it into all the other Arteries of the Body: As that Chyle which is most serous, is thus conveyed by the emulgent Arteries to the Reins, so that which is most milky, is carried by the small Branches of the *Mammariæ*, to all the Glands of the Breasts, which makes a Secretion and Filtration of one, as the *Papillary Bodies* in the Kidneys, do of the other.—All the lacteal Particles being thus rallied, and reunited, make up a Body of Milk, which is thrown by the Pipes of these Glands, into the Cistern of the Milk, and continues there till the Child sucks it out through the small *Tubuli*, that runs from the Cistern.

This Opinion is confirmed by a particular Case, mentioned by Mr. *Dionis*, who affirms, that in 1684, he saw at *Valenciennes*, a young Girl, who voided a great deal of Milk at one of her Thighs, which had began to issue from her about the eighth Year of her Age, and had still continued upon her, notwithstanding she was visited by her Terms at the usual Period; that in each Porosity, through which the Milk issued, there was a small Hardness resembling a swell'd Gland; and that this Milk was of the same Nature with that of the Breasts.

These Circumstances prove that Milk is a thick Chyle, which circulates along with the Blood, and is separated from it in the Breasts; and may find an Exit in the other Parts of the Body, when their Porosities are over dilated, as those of the Glandules of the Thigh were in this Case.

The Fermentation of the Milk in the Breasts, the first Days after a Woman is delivered, occasions a Fever, which takes its Name therefrom.

Aristotle says, there are some Men who have Milk in their Breasts.—*Cardan* tells us he saw one that had enough to suckle a Child.

Milk, corrupted in the Stomachs of Children, oc-

casions the several Diseases incident to that Age. *Dobel*, a Danish Physician, who has wrote expressly on this Subject, tells us, an excellent Remedy in such Case, is a Glass of Water with a little Salt dissolved in it: This acts as an Emetic, and throws up the Corruption that occasioned the Disorder.

Celsus mentions this Remedy: l. c. 3.

'Tis a common Allegation, that Children take their Manners from their Nurses, and partake of their good and bad Qualities; but this is not to be always credited; forasmuch as Children brought up with Cows-Milk or Goats-Milk, are unacquainted with the brutish Dispositions of these Animals.

Another Remark which I'll make *en Passant*, is, that Nurses injure their Children by suckling them too often: They use to say that it is a good Sign when Children throw up the Milk; but, on the contrary, that Redundancy of Milk makes them so fat, that they are oftentimes carried off with a continual Fever.

The Parts of the *Thorax* that lie next in Order are the Muscles, which I'll pass over in Silence 'till I come to speak of the Muscles in general.

The next to these are the bony and cartilagineous Parts of the Breast, of which I have discoursed at large in the *Osteology*.—Therefore we'll proceed to the fourth Class of the containing Parts of the Breast, which are called Membranous, viz. the *Pleura* and the *Mediastinum*.

The *PLEURA* is a Membrane, which lines the Inside of the Cavity of the Breast, and incloses all the Parts contained therein, being of the same Figure and Extent as the *Thorax* itself, and of the same Substance with the *Peritonæum*.

It is very fine and thin, yet manifestly double; thickest about the Back, where it is fastened to the Ligaments of the *Vertebrae*, from whence it takes its Rise. 'Tis likewise fastened to the *Periosteum* of the *Costæ*, and the intercostal Muscles, and after that is inserted in the Inner and Fore-part of the *Sternum*.

In the Middle of the *Thorax* it is doubled, which Duplication forms what we call *Mediastinum*. (G)—It has several Holes, some of which lie above and afford a Passage to the great Artery, the *Vena Cava*, the Gullet, the Wind-pipe, and the Nerves of the eighth Pair; the others lie below for the Passage of the *Vena Cava* and the Gullet.

The *Pleura* receives several Nerves from the *Vertebrae* of the Back, and from the eighth Pair, which renders the Wounds of that Part both dangerous and painful. It derives its Arteries from the intercostal and great Artery, and sends its Veins to the *Intercostalis Superior*, and the *Ægygos*.

The Use of the *Pleura* is to defend the Inside of the *Thorax*, and render it smooth that the Lungs may not be hurt in their Motion.

The *MEDIASTINUM* is a double Membrane, formed by a Duplication of the *Pleura*; serving to divide the *Thorax* and the Lungs into two Parts; and to sustain the *Viscera*, and prevent their falling from one Side of the *Thorax* to the other.

It proceeds from the *Sternum*, and passing strait down through the Middle of the *Thorax* to the *Vertebrae*, divides its Cavity into two.—It contains the Heart between its two *Lamellæ*, and it affords a Passage to the *Vena Cava*, the *Æsophagus*, and the stomachic Nerves.—The Membranes of the *Mediastinum* are finer and thinner than the *Pleura*, and have a little Fat.—It receives Branches of Veins and Arteries from the Mamillary and Diaphragmatic, particularly one called *Mediastina*; its Nerves come from the Stomachic: It has also some Lymphatics, which open into the *Thoracic Duct*.

The *Mediastinum* divides the *Thorax* longitudinally into two Parts; to the End that one Lobe of the Lungs may officiate, if the other be hindered by a Wound on the other Side.—Sometimes there is Matter contained betwixt its Membranes, immediately under the *Sternum*, which may occasion the Tapping of this Place.

The

The PERICARDIUM (K) is a Membranous *Capfula*, or Pouch, which includes the Heart.——It consists of a double Membrane; the inner arising from the Coats of the Vessels of the Heart, and the outer from the *Mediastinum*.——Its Figure resembles that of the Heart Conoidal; and it embraces the Heart laxly, allowing Room for its Pulsation.

It is connected either immediately, or by *Vesiculae*, emitted from it to the *Sternum*, Back, Jugulum, and to the tendinous Parts of the Diaphragm.

Its Use is supposed to be to defend the Heart; as likewise to contain a soft, serous Humour, which serves to lubricate, and moisten the Heart, and prevent any Inflammation that might probably arise, from the dry Friction of the Heart, and its *Capfula*. But this latter Use is controverted; for some take the Humour found in it to be unnatural; and will have it forcibly separated, by the convulsive Agonies supervening in the Articles of Death. In Effect, Anatomists are puzzled to find whence it should come, or from what Vessel it is secreted.

Dr. Keil in his Treatise of Animal Secretion, shews that the Liquor in the *Pericardium* must be the most fluid of any separated from the Blood, because its Particles uniting first, will have the greatest attractive Force, consequently their Particles must be the most spherical, and most solid; and therefore their Contact the least of any, therefore the most fluid.

In the Memoirs of the *French Academy*, M. de Mortal gives an Instance of a *Pericardium*, which being opened, the Liquor contained therein was found congealed into a Consistence, fit to be cut with a Knife, and two square Fingers thick about the Heart.

When the *Pericardium* is opened, we come in Sight of the *Heart*, the most considerable Part in Men.——This Part is look'd upon as the first and last Principle of Life; for it no sooner moves, than the *Fetus* begins to live; and the Cessation of its Motion, dissolves the whole Machine. So that 'tis justly called the first Thing that lives, and the last Thing that dies.

The HEART (L) is a musculous Part of the animal Body situate in the *Thorax*, wherein the Veins all terminate, and from which all the Arteries arise; and which by its alternate Contraction and Dilatation, is the chief Instrument of the Circulation of the Blood.

The Figure of the *Heart* is a Cone, or Pyramid reversed; the upper and broader Point whereof, is called the *Bas*s; and the lower, the *Cone*, *Apex*, or Point, which is turned a little towards the left Side.

Its Magnitude is indeterminate, and different in several Subjects, according to their respective Dimensions.——Its ordinary Length is about six Inches, its Breadth, at the *Bas*s, four or five; and the whole Circumference fourteen.——Its Place is the Middle of the *Thorax*, between the two Lobes of the Lungs; and it is fastened to the *Mediastinum*, and *Pericardium*, and supported by the great Blood-vessels, to which alone it is immediately connected; being for the Convenience of its Motion, disengaged from any other impediments.——It is covered with a thin Membrane, which, about the *Bas*s, is guarded with Fat; and which is no other than the common Membrane of the Muscles.

The Substance of the *Heart* is carnosous, and resembles that of other Muscles, abating that it's harder, especially at the *Tip*, and that its Motions are involuntary.——It consists of two Sorts of fleshy Fibres, *viz.* an outer, and an inner Sort, both of which have their Origin and Insertion in the *Bas*s of the Heart.

The outer Fibres descend from the *Bas*s, in a spiral Line, moving from the Right to the Left, towards the *Tip*, where they cast a Semi-circle; and re-ascend in a spiral Line from the Left to the Right, towards the *Bas*s.——The inner Fibres descend in a straight Line, from the *Bas*s to the *Tip*, and then ascend directly from the *Tip* to the *Bas*s, where they

terminate.——The little fleshy Columns of the Ventricles, are formed of these inner Fibres; and in the Middle of these Fibres, the two Ventricles are seated; the Orifice, and Valves of which, are made by the Dilatation of their Tendons.

The Fibres of the *Heart* (L) appearing to be the same with those of the other Muscles, that Part, now, generally passes for a real Muscle; though some think the Inference not over just, in as much as the *Aorta* has the same Claim to be reputed a Muscle.

Some late Authors, upon considering the Structure and Position of the spiral Fibres, chuse rather to make the *Heart* a double Muscle, or two Muscles tied together.——In Effect, the two Ventricles, with their respective Auricles, are found two distinct Bodies, two Vessels, or Cavities which may be separated, and yet remain Vessels; the *Septum*, which was supposed to belong only to the Left, being now found to consist of Fibres derived from them both.——To say no more, the two Ventricles, according to Mr. Winslow, are two several Muscles, united together, not only by the *Septum*, but by several Plans of Fibres, arising from the exterior *Base* of the *Heart*, and meeting at the *Apex*, which entering the left Ventricle, line the *Parietes*, &c.

The *Heart* is covered with a Membrane (M) as well as all the other Muscles of the Body; and this Membrane sticks so close to the Flesh, that 'tis very hard to part 'em. We meet with a great deal of Fat underneath it, especially about the *Bas*s of the *Heart*, for the *Tip* has not near so much. This Fat is of Use to moisten the *Heart*, for fear its Motion should over dry it.

Sometimes we find the *Tendons* of the fleshy Fibres of the *Heart* ossified towards the upper Part of the *Septum*, in human Bodies; and sometimes there are Lumps of Fat in the Ventricle, with Caruncles, and Hair, rendring 'em all over rough; but these Instances are so rare, that they scarce deserve our Attention.

The Nerves of the *Heart* come from a *Plexus* of the *Parvagum*, called by WILLIS, *Plexus Cardiacus*. Those Nerves are so small, and so hard to be traced, that a great many Anatomists have concluded, that the *Heart* has no Nerves; which Slenderness proceeds, perhaps, from the little Occasion the *Heart* has of animal Spirits to perform its Motion, the Entry of the Blood being sufficient for its Dilatation, and Contraction; and as for its Sense, that requires but few Spirits; for the continual Agitation of the *Heart*, supersedes the Use of an exquisite Sense.

(N). The two Arteries of the *Heart* are called *Coronariae*, because they gird its *Bas*s like a Crown.——They proceed from the great Artery, immediately upon its Egress from the *Heart*, and even before its Exit from the *Pericardium*: So that here, the *Heart*, distributes the first Portion of the Blood that is but just perfected, in its Ventricles.——The *Heart* has, likewise, a Vein (called *Coronaria*) which climbs along its outer Part, and consists of several Branches flowing from all the Parts of the *Heart*.——This Vein repairs to the *Cava*, and there deposits the superfluous Blood, imported by the *Arteria Coronaria*.——The *Heart* is in like Manner provided with *Lymphae Ductus*, which disembogue in the Thoracick Duct.

The *Heart* has two great Cavities, called VENTRICLES, somewhat unequal, the Right being larger, capable to contain two or three Ounces of Blood.——They are divided by a fleshy Partition, consisting of the same muscular Fibres, with the *Parietes* themselves, and called the *Septum*, the Figure whereof is concave, towards the left Ventricle, and convex towards the Right.——There is no immediate Communication between the Ventricles; but for the Blood to pass out of one into the other.

The *Parietes*, or Sides of these Ventricles, are of a Thickness and Strength very unequal; the Left much exceeding the Right, because of its Office, which is

to force the Blood through all the Parts of the Body ; whereas the Right drives it through the Lungs only, and is therein greatly assisted by other Parts.—The right *Ventricle*, in Effect, seems wholly intended to the Lungs ; whence in Animals, who have no Lungs, we only find one *Ventricle*, which is the Left.

In the *Ventricles* are little Muscles (called *Columnæ Carneæ*, or *Lacertali*) derived from the *Parietes*, and connected by tendinous Extremities, to the Valves of the *Heart*.

(OO) The *Ventricles* are capped each with an *Auricle*, which are Productions or membranous Appendages made of a Duplicature of the Membranes of the Vessels in which they are placed ; the right *Auricle* being the Extremity of the *Vena Cava*, and the Left that of the *Vena Pulmonaria*, so that they seem to make but one Body with these Vessels. In Size they are Proportional to the Vessels in which they are seated, and to the *Ventricles* of the *Heart* ; for the right *Auricle* is larger than the Left, because the *Vena Cava* is bigger than the *Pulmonaria*, and the right *Ventricle* larger than the Left.—If we take a narrow View of the Structure of these *Auricles*, we'll perceive all their Actions depend on the Motions of the *Heart*, for their *Diole* is Cotemporary with the *Heart's Systole*, and so their Motions are Alternatives.

The *Auricles* of the *Heart* receiving the Blood from the Veins serve for a Measure to the *Heart*, and to prevent Irruption of too great a Quantity, or the over-precipitant Course of the Blood into the *Ventricles*, which might suffocate the Animal.—But upon the Suppression of a violent Passion, the *Heart* may so contract itself, that the Blood repulsed into the *Auricles* may break their Spring, and unbend them, so as that they will gradually extend themselves, pursuant to the following Observation.

Captain *Du Bouillon* dying at *Brest* in *France*, in the 42d Year of his Age, soon after his Return from *Carthage* ; his Body was opened, and the right *Auricle* of the *Heart* was found as big as the Head of a new-born Child, and capable to contain a Pint and a half of Blood : 'Twas lined within with a bony and scaly Substance, which kept it always extended like a Foot-Ball.—It seems the Captain had a very great Difficulty of breathing, a rough and frequent Pulse, and a continual Pulsation of the *Heart*, which was so violent that it was observable under the *Sternum*. The Patient still averr'd, that his Malady had commenced twelve or thirteen Years before, and was occasioned by the Violence he did to himself in suppressing the first Motions of a great Passion, at which Time he was first attacked by the fore-mentioned Symptoms, that encreased ever after 'till the Day of his Death.

The Use of the *Heart*, and its appendant *Auricles*, is to circulate the Blood through the whole Body : In Order to which, they have an alternate Motion of Contraction and Dilatation.—By the Dilatation, called the *DIASTOLE*, their Cavity is opened, and their internal Dimensions enlarged, to receive the re-fluent Blood from the Veins ; and by their Contraction, called the *SYSTOLE*, their Cavity is shrunk, and their Dimensions lessen'd, to expel the Blood again into the *Arteries*.—It must be observed that these alternate Motions of the *Heart* and *Auricles* are opposite in Time to each other ; the *Auricles* being dilated whilst the *Heart* is contracted again ; and contracted whilst it is dilated to drive the Blood into it.

By means of the right *Ventricle*, the Blood is driven through the Pulmonary Vein, from which being received into the Pulmonary Artery, it is returned to the left *Ventricle* ; from which, by the *Aorta*, it is distributed all over the rest of the Body, and thence returned to the right *Ventricle* by the *Vena Cava* ; so making an entire Circulation through the whole Body.

The Principle of Motion in the *Heart*, or the Power from which its alternate Contraction and Di-

latation arises, has been greatly controverted among the late Physicians and Anatomists.

The Expulsion of the Blood out of the *Ventricles* argues a very considerable Motion in the Part.—The motive Power, it is certain, must surmount the Resistance made to it ; and according to *Borelli's* Computation, the Resistance made to the Motion of the Blood through the Arteries, is equal to 180000 Pounds, which therefore are to be removed by the *Heart*, or else the Circulation must cease. Now whence comes the Machine of the *Heart* to have such a Power ? And after the Expulsion, what other Power is it that surmounts the former, and restores its Part to the Dilatation, to produce a reciprocal *Æsus* ?

Des Cartes alledges, that in each *Ventricle*, there are some Remains of the Blood, which missing of an *Exit*, when the *Heart* was contracted, turn sour, and become a Ferment, qualified to ferment with the fresh Blood, just as Oil of Tartar does with Spirit of Vitriol ; upon this Foundation he accounts for the Motion of the *Heart* in the following Manner.

When a gross Drop of Blood falls by its own Weight into either *Ventricle*, it presently swells, and rarifies, because of its mixing with the Ferment it meets with.—The Drop thus fermented taking up more Room in the *Heart* than before, removes its *Parietes* from one another, enlarges it and obliges the Point or *Tip* to approach to the *Bas*.—At last when the *Heart* admits of no farther Dilatation, this Drop tending still to take up more Room, storms the *Sigmoide* Valves, and repairs to the Arteries.—But when its Ebullition ceases, and the Blood thus rarified has lost its great Motion, as being condensed ; the *Heart* by Virtue of its Elastic Spring lengthens itself, and removes its Point from the *Bas* ; upon which a fresh Drop of Blood repairing to each *Ventricle*, because nothing then shuts the *Tricuspid* Valves, is fermented by the Ferment, or sharp Remains of the preceeding Blood ; and after separating the Walls of the *Ventricles*, passes into the Arteries as above.

Some believe this *Hypothesis* contrary to Reason. 1. Because they pretend that it cannot be accounted for the first Origin of that Ferment. 2. They ask (since the sharp Remains are the only Cause of the Fermentation of the fresh Blood) what causes a Fermentation in the first Moment of Circulation ; since there can be no sour Blood in the *Heart*, antecedently to the first Drop that repairs thither.—To alledge, say they, that Nature forms the first Ferment, is to explain one Difficulty by another.—But even supposing (say they again) such a Ferment to be there, how can we conceive that it always continues in the *Ventricles* ? Why does not it accompany the Blood in its Egress some Time or other ; which would be enough to interrupt the Course of Circulation ? As for the Plea that the Egress of the Ferment is immaterial, because the Blood that remains acquires a Sourness sufficient to produce the same Effect ; this, say they, is scarce credible ; for whenever we find a *Tormentation*, we find likewise that the Liquors must continue for some Time in one Place, in order to compass it ; and that it is not to be supposed, that the Blood remaining in the *Heart*, can in so small a Compass of Time, be qualified to cause such a great Effervescence ; for 'tis no sooner in than its *Exit* ensues.

Upon this Account 'tis more probable that the Pulsation of the *Heart* is owing to the animal Spirits ; for if you cut or tie a Ligature upon the intercostal Nerve, and the eighth Pair, it ceases in the Space of twenty-four Hours ; and indeed it would not continue so long, if it were not for the Spirits imported by the vertebral Branches, which are joined to the intercostal.—This Pulsation depends likewise on the Blood ; for if you tie a Ligature upon the Vessels, the *Vena Cava* for Instance, the Pulsation ceases, and recommences when the Ligature is taken off.—The Recommendation is owing to the Heat of the Blood.

In fine this Motion is owing to the Weight of the Blood ; for the *Heart* being without an Antagonist Muscle,

Muscle, would never dilate itself after Contraction, if the Weight and Impetuosity of the Blood, was not to force it to a Dilatation; for we see in moribund Animals, that five Pulsations of the *Vena Cava* answer only to one of the right *Auricle*, and two of the *Auricles* correspond to one of the Heart, which in human Bodies is in some Measure promoted by the Motion of the Midriff, the Point of the *Pericardium* being fastened to it.

To shew how, and in what Manner this Motion is compassed, let's consider this double Spiral formed by the Fibres of the Heart, and how these Fibres cross one another upon the inner Surface of the *Ventricles*.—Upon a due Consideration, we shall have the Pleasure to conceive, that as often as these Fibres act, they endeavour, by all their Parts, to describe a strait Line, the Consequence thereof is, that the Spiral must be shortened, and tend to the Form of a double Ring, so that the Middle of the Heart will be enlarged, and its *Tip* approach to the *Basis*, in Order to make an exact and forcible Expression of what is contained in the *Ventricles*; now this is what we call *Systole*, in which the Heart beats against our left Breast.——But when the Fibres unbind, they tend to disengage themselves, and to re-assume their first natural State; being assisted therein by the Impulse and Weight of the Blood flowing from the Veins, and the Motion of the Midriff, which draws the *Tip* of the Heart towards it, so that the Heart is lengthened, and the Blood fills the *Ventricles*; this we call *Diastole*.

We must observe farther that the *Auricles* of the Heart have, likewise, their *Diastole* and *Systole*, but different from those of the *Heart*; for when the *Auricles* empty themselves, the Heart fills, and as often as the Heart squeezes the Blood out of its *Ventricles*, the *Auricles* swell. The Occasion of this Difference is, that the *Auricles* are the Cisterns of the Heart.—The Blood flowing from the Veins is first conveyed into the Cavities of the *Auricles*, and does not repair to the Heart 'till the *Tricuspid* Valves give Way, and that happens just when the *Heart* is emptied.—Further, the Passage, through which the *Auricles* empty themselves, is much more considerable than that which fills them; and 'tis plain, that even this would give them Time to contract themselves, tho' their muscular Fibres were inactive.

At the *Basis* of the *Heart* we meet with four large Vessels, viz. the *Vena Cava*, the *Arteria Pulmonaris*, the *Vena Pulmonaris*, and the *Aorta*; of which the two former are inserted in the right *Ventricle*, and the other two in the Left.

(S) The *VENA CAVA* is the Biggest of all the four Vessels, and terminates in the left *Ventricle* of the *Heart*, to which it is knit so fast, that it cannot be separated.—It opens into that *Ventricle* by a wide Mouth, and pours into it the Blood that it has received from the several Branches of Veins.—Its Membrane, which is thin every where else, is very thick and full of fleshy Fibres at its Mouth; and that prevents its being rent by the continual Motion of the *Heart*, as well as its being over-extended by the large Quantity of Blood, which repairs to it from all Parts.—These fleshy Fibres serve likewise to render the Vein capable of some Contraction, in Order to forward the Blood to the *Ventricle*.

(T) The three triangular and membranous VALVES, called *Tricuspid*, are placed at the Mouth of the *Cava*.—They are formed of a Dilatation of the Tendons of the Muscles, of which the *Heart* consists.—They open from without inwards; and are so disposed as to favour the Passage of the Blood from the *Cava* to the *Heart*, and oppose its Retreat.

The *Vena Cava* serves to receive the Blood from the Branches of the Veins, repairing to it from all the Parts of the Body, and to pour it into the Cavity of the *Auricle*, from which, as from a Measure, it falls into the right *Ventricle* of the *Heart*.

The *Arteria Pulmonaris*, or *Vena Arteriosa*, rises from the right *Ventricle* of the *Heart*, but its Mouth is less than that of the *Cava*.—This Artery is divided

into two great Branches, which, after a Subdivision into several small Shoots, are dispersed upon the Right and Left, through the whole Substance of the Lungs.—The three Valves (called *Sigmoides* from their Resemblance to the Greek *Sigma*) are placed at the Entrance of the *Arteria Pulmonaris*.—These Valves are little Membranes, seated by one another in a different Manner from those of the *Cava*; for they open from within outwards, to afford a Passage for the Blood from the right *Ventricle* into the Artery, and oppose its Retreat.

The *Arteria Pulmonaris* serves to receive the Blood from the right *Ventricle* of the *Heart*, and disperse it in the Substance of the Lungs.

(X) The *VENA PULMONARIS*, or *Arteria Venosa*, proceeds from the Lungs by an Infinity of small Shoots, which, after uniting into one Trunk, march out of the Substance of the Lungs, and empty themselves into the left *Ventricle* of the *Heart*.

At the Entrance of this Vein are placed two Valves (called *Mitrales*, from their Resemblance to a Bishop's Mitre) their Situation is like that of the *Tricuspid*, for they open from without inwards, to favour the Blood's Entry into the left *Ventricle*, and oppose its Return to the Veins.—The Capillary Branches of the *Vena Pulmonaris*, being dispersed through the Substance of the Lungs, takes up the Blood imported by the *Arteria Pulmonaris*, and convey it to the left *Auricle* of the *Heart*.—Together with the Blood this Vein imports likewise, the subtlest Parts of the Air, which pass from the Extremity of the *Trachea* into its Trunk.

(Y) The GREAT ARTERY, called *Aorta*, is the Trunk and Source of all the other Arteries of the Body, those of the Lungs excepted, which are the Branches of the Artery of the right *Ventricle*.—It has several hard and thick Coats.—It proceeds from the left *Ventricle* of the *Heart*, at which Part it seems to be cartilaginous, being thereby kept always open, and ready to receive the Blood which flows with great Impetuosity from the *Ventricle*.

(Z) The Head of the *Aorta* is provided with three Valves, or membranous Appendages.—They look from within outwards, in Order to let the Blood pass from the left *Ventricle* to the *Aorta*; and prevent its Reflux from the *Aorta* to the *Ventricle*.

The *Aorta* distributes the Blood, that flows into it from the *Heart*, to all the Parts of the Body, which is effused in the following Manner.

The Blood galling out with an impetuous Force from the left *Ventricle*, is thrown into the *Aorta* by the Contraction of the *Heart*. The subtlest Part of this Blood mounts upwards through the upper Trunk of the *Aorta*, and is distributed into the Arms by the Axillary Arteries, and into the Head by the *Arteriae Carotides*, and *Cervicales*.—On the other Hand the coarser Sort of Blood falls downwards through the lower Branch of the same Artery; and is dispersed to all the Parts that lie below the *Heart*, by the Arteries called *Celiac*, *Mesenterick*, *Emulgent*, *Spermatick*, *Iliack*, and an Infinity of other Branches.

In this Circulation the several Liquors contained in the Mass of the Blood, are separated from it in several Parts, by Virtue of the Configuration of the Pores of the Parts through which it passes, viz. The Animal Juice is separated in the Brain; the Secretion of the Saliva is performed in the *Parotides*, and the Glands of the Jaws; that of the acid Liquor in the Glands of the *Œsophagus*, and the Stomach; the *Pancreatick Juice* in the *Pancreas*, or Sweet-Bread; the Choler in the Liver; the Urine in the Kidneys; the Seed in the Testicles; the Milk in the Breasts, and several other Liquors in an Infinity of other Parts.

The Blood being conveyed by the two Trunks of the *Aorta*, to all the Parts of the Body, both above and below, marches out of the Extremities of the capillary Arteries, in order to nourish the Parts: And for as much as the whole Mass thus extravasated, is not quite consumed, the Surplusage re-enters the Orifices of the capillary Veins, by the Impulse of the fresh

fresh Blood, which ouzes without Intermiſſion from the little Arteries, and obliges its Fore-runners to return thro' the ſmall Veins to thoſe of a larger Size; by which means the Blood ſent to the Head, returns by the jugular Veins, and that to the Arms by the Axillary, and both theſe terminate in the Subclavian, which leads to the upper Trunk of the *Cava*, and ſo to the Heart: In like Manner, the Blood diſpenſed to the lower Parts, returns to the Heart by the Iliack, and all the other Veins of the *Abdomen*, which unload in the lower and aſcending Trunk of the *Cava*, and with joint Forces falls into the right Auricle; where the Diſpoſition of the *Tricuspides* Valves, and the Contraction of the Heart, forward it to the *Arteria Pulmonaris*.

The *Arteria Pulmonaris* having received the Blood, conveys it to the Lungs, and diſperſes it through their whole Subſtance, from whence being accompanied with the ſubtileſt Part of the Air that joins it from the Extremities of the *Trachæ*, it paſſes to the Branches of the *Vena Pulmonaria*, from thence to the left Auricle of the Heart, and ſo it enters the Ventricle of that Side.—In that Part the Diſpoſition of the Valves prevents its Reſlux; upon which, by the Contraction of the Heart, it flies out impetuoſly into the great Artery, and this Artery diſpenſes it to all the Parts of the Body.—From all theſe Parts it returns by the capillary Veins, to the great ones, and from thence to the upper and lower Trunk of the *Cava*, in Order to renew the inceſſant Circulation, the Ceſſation of which, for one Moment, would put a Period to the animal Life.

Mr. *Robault* ſuppoſes that it is very eaſy to diſcover, by the Pulſation of the Heart, in what Space of Time, the Circulation of the Blood can be accompliſhed.—He preſuppoſes, that a certain Quantity of Blood enters the *Aorta*, at each Pulſation of the Heart, which he believes cannot be leſs than a Drachm. This preſuppoſed, he begins his Calculation thus.

He finds by his Pulſe, that there happen, ſixty-four Pulſations of his Heart, in the Space of a Minute; whence it follows, that his Heart beat 3840 Times in the Space of an Hour, and conſequently, that 92160 Drachms, or 11520 Ounces, or 720 Pounds of Blood, paſs every Day through the Heart; ſo that if it could be reaſonably ſuppoſed, that there is ſo much Blood in a human Body, there would be in twenty-four Hours, but one Circulation of the whole Maſs of Blood: But as in Mr. *Robault's* Opinion, there is ſcarce more than ten Pounds of Blood in a human Body. He believes that the whole Maſs paſſes 702 Times through the Heart in twenty-four Hours, and conſequently, there happens three Circulations of the whole Blood in the Space of an Hour.

In a *Fœtus*, the Apparatus for Circulation is ſomewhat different from that above deſcribed.—The *Septum* which ſeparates the two Auricles of the Heart, is pierced through with an Aperture, called the *Foramen Ovale*; and the Trunk of the Pulmonary Artery, a little after it has left the Heart, ſends out a Tube in the deſcending *Aorta*, called the *Communicating Canal*.

The *Fœtus* being born, the *Foramen Ovale* closes, by Degrees, and the Canal of Communication dries up, and becomes a ſimple Ligament.

This Mechanism once known, it is eaſy to perceive its Uſe.—For, while the *Fœtus* is incloſed in the *Uterus*, it receives no Air but that little, furniſhed by the umbilical Vein: Its Lungs therefore cannot ſwell and ſubſide as they do after the Birth, and after the free Admiſſion of the Air. They continue almoſt at Reſt and without any Motion; their Veſſels are, as it were full of themſelves, and do not allow the Blood to circulate either in Abundance, or with Eaſe.

Nature therefore has excuſed the Lungs from the Paſſage of the greateſt Part of the Blood; and has contrived the *Foramen Ovale*, by which Part of the Blood of the *Vena Cava*, received into the right Au-

ricle, paſſes into the left Auricle, as the Mouth of the Pulmonary Veins; and by this Means is found as far in its Journey, as if it had paſſed the Lungs.

But this is not all; for the Blood of the *Cava*, which miſſing the *Foramen Ovale*, paſſes from the right Auricle, into the right Ventricle; being ſtill in too great Quantity to paſs by the Lungs, whither it is driven through the Pulmonary Artery; the communicant Canal intercepts Part of it in the Way, and pours it immediately into the deſcending *Aorta*.

This is the Doctrin of *Harvey*, *Lower*, and moſt other Anatomists. But M. *Mery*, of the Royal Academy, has made an Innovation in it.

He aſſigns another Uſe for the *Foramen Ovale*; and maintains that the whole Maſs of Blood, brought from the *Cava* to the right Ventricle, paſſes, as in Adults, into the Pulmonary Artery, whence Part of it is conveyed by the communicant Canal, into the *Aorta*; and the reſt brought from the Lungs by the Pulmonary Veins into the left Auricle, where it is divided into two Parts, the one paſſing through the *Foramen Ovale*, into the right Ventricle, without circulating thro' the *Aorta*, and the reſt of the Body; the other Part pushed, as in Adults, by the Contraction of the left Ventricle, into the *Aorta*, and the whole Body of the *Fœtus*.

Mr. *Du Verney* aſſerts, on the contrary, that the *Foramen Ovale*, has a Valve ſo diſpoſed, as to be opened by the Blood driving into the right Ventricle, but ſhut the more firmly, by its pushing into the Left. Mr. *Mery* denies the Exiſtence of any ſuch Valve.

According to the common Opinion, the *Aorta* receiving more Blood than the Pulmonary, ſhould be bigger.—According to the Opinion of Mr. *Mery*, the Pulmonary Artery ſhould be the biggeſt, as being eſteemed to receive a larger Quantity of Blood.

Therefore, to judge of the two Systems; it ſhould ſeem there needed nothing, but to determine which of the two Veſſels were the biggeſt in the *Fœtus*.

Mr. *Mery* always found the Pulmonary Artery half as big again as the *Aorta*; and, on the other Hand, Mr. *Tauvry*, who ſeconded Mr. *Du Verney*, produces Caſes, where the Pulmonary is leſs than the *Aorta*. The Faſts on both Sides was examined by the French Royal Academy.

Mr. *Tauvry* adds, that though the Pulmonary Artery ſhould be greater than the *Aorta*, yet this does not prove, that more Blood paſſes the firſt, than the ſecond; ſince it may be accounted for, from the Blood's preſſing more ſlowly towards the Lungs, which it finds ſome Difficulty to penetrate, and accordingly ſwells and is driven back.

Mr. *Littre*, upon diſſecting an Adult, in whom the *Foramen Ovale* was ſtill open, and meaſuring the Capacities of the Veſſel on each Side, declares for Mr. *Mery*.

For the Source of the Circulation in the *Fœtus*, Anatomists are again divided.—The popular Opinion is, that during Geſtation, the Arteries of the *Uterus* convey their Blood into the *Placenta*, which is nourished by it, and the Surplus conveyed into the Root of the umbilical Vein, which makes Part of the Navel-string: Thence it is carried to the Liver of the *Fœtus*, where it enters the *Vena Cava*, and is thence conveyed to the right Ventricle of the Heart, and diſtributed as before.

Again, the Blood brought from the Iliac Arteries of the *Fœtus*, enters the Navel-string, by the umbilical Arteries; thence paſſes into the *Placenta*, where it is reſumed by the Veins of the *Uterus*, which carry it back again to the Mother; and perhaps alſo, by the Roots of the umbilical Veins, which mix it afreſh with the Blood of the Mother.

Therefore, according to this System, it is the Blood of the Mother that ſupplies the Child, which is here only regarded as a diſtinct Member, or Part of her Frame.

The Beating of her Heart ſends it a Portion of her Blood;

Blood; and so much of the Impulse is preserved, as suffices to maintain that languid Circulation, which a *Fœtus* enjoys: And in all Probability, gives that feeble Pulsation observed in the Heart.

Other Anatomists maintain, that the *Fœtus* is only supplied with Chyle, from the Glands of the *Uterus*; which is further elaborated, and turned into Blood, in the Vessels of the *Fœtus*; and circulates therein, without any further Communication with the Mother.—These allow of no reciprocal Circulation, excepting between the *Placenta* and the *Fœtus*.

But the former Opinion is best supported; for the *Placenta* being separated from the *Uterus*, during the Time of Gestation, neither yields any Chyle, nor any Thing but Blood.

The Circulation of the Blood has been generally allowed to have been first discovered in *England*, in the Year 1628, by the celebrated Dr. *Harvey*, though there are several Authors who dispute it with him.

Jansson of *Almoloven*, in a Treatise of *New Inventions*, printed in 1684, quotes several Passages from *Hippocrates*, to prove that the Circulation was known to him.—*Wallæus Epist. ad Baribol.* pretends it was known not only to *Hippocrates*, but also to *Plato* and *Aristotle*.—It is added, that the *Chinese* Physicians taught it 400 Years e're it was spoke of in *Europe*.

Some go back as far as *Solomon*, and imagine they see some Traces of it in the *Ecclesiastes*, Chap. xii. *Bern. Genga* in an *Italian* Treatise of *Anatomy*, quotes several Passages from *Realdus Columbus* and *And. Cæsalpinus*, whereby he endeavours to prove that they admitted a Circulation long enough before *Harvey*.

He adds, that *Fra. Paolo Sarpi* the famous *Venetian*, from a Consideration of the Structure of the Valves of the Veins, and other Experiments, concluded a Circulation.

Leoniceus adds, that *Fra. Paolo* durst not make known his Discovery for fear of the Inquisition; that he therefore only communicated the Secret to *Fabius ab Aquapendente*; who, after his Death, deposited the Book he had composed on it in the Library of *St. Mark*, where it lay hid a long time, till *Aquapendente* discovered the Secret to *Harvey*, who then studied under him at *Padua*; and who, upon his Return to *England*, a Country of Liberty, publish'd it as his own.—But much of this is Fable. Sir *George Ent* has shewn, that Father *Paul* received the first Notice of the Circulation of the Blood from *Harvey's* Book on the Subject, which was carried to *Venice* by the Ambassador of the Repulick at the Court of *England*, who shew'd it to Father *Paul*, by whom some Extracts were made from it, which coming afterwards into the Hands of his Heirs, gave Rise to an Opinion in several Persons that he was the Author of the Papers, and the Inventor.

The LUNGS (AA) which are the next Part we are to observe in the *Thorax*, are nothing else but a Collection of little membranous Vesicles heaped one above another, and interlaced with Branches of Arteries and Veins.

(BB) Those Bladders are formed of the Extremities of the inner Coat of the *Trachea*, or Wind-pipe, and all wrapt up in a Membrane.—Their outside is convex, and raised upon the Sides where they touch the Ribs, but their Inside is concave, whereby they can embrace the Heart with greater Facility.

The Lungs are connected above to the *Fauces* by means of the *Trachea*; and below to the *Vertebrae* of the *Thorax*; and to the *Sternum* and *Diaphragma* by means of the *Pleura*, to which they sometimes adhere, even from the first Conformation of those Parts, which Adhesion is more useful than pernicious, not only because the Lungs being obliged to follow the Dilatation of the *Thorax*, do it more easily when they are thus fastened; but likewise because by this means they do not press so much upon the Heart.

(CC) They are divided into two great Lobes by

the *Mediastinum*, and those again subdivided into several other Lobes or Lobules; the Right sometimes into three or four, by means of some Fissures running from the fore to the back Edge.—The great Lobes, when inflated, resemble each of them a Horse's Hoof in Figure, but together they are like an Ox's inverted.

The whole Substance of the Lungs is covered with a common Membrane, which is divisible into two Coats; the outer, thin, smooth, and nervous; the inner, somewhat thicker and rougher, consisting mostly of the Extremities of Vessels and Vesicles, thro' the Impression of which it is pitted, and resembles in some measure a Honey-comb.

The Vessels of the Lungs are the *Bronchia*, the Pulmonary and Bronchial Arteries and Veins, Nerves and Lymphaticks.—Of these Vessels some are proper, and some common; the common are the *Bronchia*, the Pulmonary Artery and Vein, the Nerves and Lymphaticks; the proper are the Bronchial Artery and Vein.

(ΔΔ) Dr. *Willis* and Mr. *Dionis* ascribe to the Lungs a great Number of Nerves from the *Par vagum*, which are dispersed all over its Substance, and embrace the aerious and sanguiferous Vessels. He also asserts, that the *Vesiculæ* have musculous Fibres, to enable them to exerce a greater contractive Force in Expiration, though others deny such Fibres.

Diemerbroeck observes, that the Vesicles admit not only of Air, but also of other grosser Matters; and instances two asthmatick Persons which he opened; the one a Stone-cutter, the *Vesiculæ* of whose Lungs were so stuffed with Dust, that in cutting, his Knife went as if thro' a Heap of Sand; and the other a Feather-Driver, in whom the Vessels were full of the fine Dust, or Down of Feather.—*Si credere fas est.*

(EF) Before we inquire into the Use of the Lungs, it is not improper to observe, that the *Trachea*, or Wind-pipe, is a Passage which reaches from the Mouth to the Lungs.—'Tis placed upon the *Oesophagus*, or Gullet, which it accompanies to the fourth *Vertebra* of the Breast, and there splits into two Branches which enter the Lungs, one on each side. These Branches are afterwards divided into as many Twigs as there are Lobes; and the Twigs are again subdivided into a Number of smaller Shoots, answerable to that of the Lobules in each Lobe; so that all the small Vesicles in each little Lobule are furnish'd with Branches.

The Branches of the Artery, and Pulmonary Vein, are constant Companions of those of the *Trachea*, and they jointly terminate in the Lobes and Lobules; so that we may justly apprehend, that each Lobule being composed of several little round Vesicles, is a sort of little Lungs; just as every small Cluster of Grapes, is a little Bunch.

The constituent Parts of the *Trachea* are several Cartilages, Ligaments, and two Membranes.—The Cartilages are semicircular before, and upon the Sides they are hard, and sometimes ossified; but their backside is membranous, which give them the Form of an Half Moon.—They are ranged one above another, and grow smaller as they approach to the Lungs. They are so contrived, that by entering into one another, like the Scales of a Crab's Tail, they lengthen themselves in Inspiration, and shorten in Expiration and Expectoration.

They are all fastened to one another by Ligaments which run between them, and which some have mistaken for Muscles.

The *Trachea* has two Membranes; a very strong outer one which ties the Cartilages together, and hinders their Dilatation; and the inner Membrane, which is but a Continuation of the Palate of the Mouth, and serves to line its Inside in the *Larynx*, or Entrance of the *Trachea*; this Coat is very thick, indurated in the Middle, and very thin in the Branches inserted in the Lungs.—Its Sense is so exquisite

that it can suffer nothing; for when any Portion of Food, or Drink, falls into its Cavity, we never cease coughing till we have dislodged it again.—'Tis liquored over with a Fat Humour that keeps it always supple, in order to form the Voice, and prevent its being dry'd or injured by the sharp and fuliginous Excrements that pass through the Wind-pipe. The Abundance of this Humour causes a Hoarseness; but its excessive Redundancy occasions the Loss of one's Voice, which retrieves so soon as the Humour is consumed.

The *Trachea* receives Branches of Nerves, from the recurrent Branches of the eighth Pair; Arteries from the *Carotides*; and its Veins unload in the external *Jugulares*. Its Nerves being dispersed through its whole inner Membrane, cause its exquisite Sense.

The *Trachea*, and its *Bronchia* serve to conduct the Air into the Lungs, in the *Inspiration*, and to return it again in the Time of *Expiration*.

The *INSPIRATION* is the Ingress of the Air, ensuing upon the Dilatation of the *Thorax*, and the *Lungs*; and the *Expiration*, the Egress of the Air; together with a vaporous Lympha, procured by the Contraction of the same Parts.

This Ingress or Admission of the Air depends immediately on its Springs, or Elasticity, at the Time when the Cavity of the Breast is enlarged, by the Elevation of the *Thorax* and *Abdomen*, and particularly by the Motion of the *Diaphragm* downwards: So that the Air does not enter the Lungs, because they are dilated; but those dilate because the Air enters within them. Nor is it the Dilatation of the Breast which draws in the Air, as is commonly thought, but an actual Intrusion of the Air into the *Lungs*.

EXPIRATION is performed by a Contraction of the Cavity of the Breast, and the Parts employed in the *Inspiration*, re-assuming their first Station.

Inspiration, and *Expiration*, form together, what we call *Respiration*.

But for a clearer Explanation of this Subject, and of the Manner wherein *Respiration* is perform'd, we must observe, that the *Lungs*, when suspended in the open Air, by the contractive Power of the muscular Fibres which tie together the squamous Parts, the *Bronchia* are reduced to less Space, than they possess, while in the Cavity of the *Thorax*; and when thus contracted, if a Quantity of new Air be injected through the *Glottis*; they again become distended, so as to possess an equal, nay, a greater Space, than that assigned them in the *Thorax*.

Hence it appears, that the Lungs, by their proper Force, are always endeavouring to contract themselves into less Compass than they possess when inclosed in the *Thorax*; and that therefore they are always in a State of violent Dilatation, while the Man lives.—For the Air that encompasses them in the *Thorax*, shut up betwixt their external Membrane, and the *Pleura*, is not of equal Density with common Air.

In Effect, the Ingress of the Air, through the *Glottis*, into the Lungs, is always free; but that on the Outside, wherewith they are compressed, is impeded by the *Diaphragm*, so as it cannot enter the *Thorax* in a Quantity sufficient to make an *Equilibrium*.

Since then in *Inspiration*, the Air enters the Lungs in greater Quantity than it was before; it will dilate them more, and overcome their natural Force.—The Lungs therefore are wholly passive in the Matter: What it is that acts must be learnt from the *Phænomena*.

1. Then it is observed, that in *Inspiration*, the nine upper Ribs, articulated to the *Vertebrae*, and the *Sternum*, rise archwise towards the *Clavicles*; and the three lower are turned downwards; and the eighth, ninth, and tenth are drawn inwards. 2. That the *Abdomen* is dilated. And, 3. The *Thorax* enlarged. 4. The *Diaphragm* is brought from its Convex, and sinuous Position to a flat Figure.

Now as these are the only visible Actions in Inspi-

ration, the Cause of the Operation must be referred to them; or rather to the Muscles of these Parts, which are the Intercoastal, the Subclavian, &c.

The Capacity of the *Thorax*, being enlarged by the Action of these Muscles on the Ribs, &c. a Space is left between the *Pleura* and the Surface of the *Lungs*; so that the Air entering the *Glottis*, inflates them till such Times, as they become contiguous to the *Pleura* and *Diaphragm*.—In this Case now the Air presses the *Lungs* as much as the *Thorax* resists them; and hence the Lungs become at rest; the Blood passes less freely, and is forced in less Quantity into the left Ventricle of the Heart, and so less comes into the *Cerebellum*, and its Nerves, and the arterial Blood acts less on the intercoastal Muscles, and *Diaphragm*.

The Causes, therefore, which at first dilated the *Thorax*, grow weaker; consequently the Ribs become depressed, the distended Fibres of the Muscles of the *Abdomen*, restore themselves, the *Viscera* thrust the *Diaphragm* up again into the *Thorax*, the Space whereof being thus contracted, the Air is drove out of the *Lungs*; and thus is *Expiration* performed.

Immediately the Blood being quickened in its Motion, begins to flow stronger, and more plentifully to the *Cerebellum* and Muscles; and thus the Causes of the Contraction of the Intercoastals, and *Diaphragm* being renewed, *Inspiration* is repeated.—Such is the true, immediate, adequate Manner of vital *Respiration*.

The Uses and Effects of *RESPIRATION* are greatly disputed among *Anatomists*.—*Boerhaave* takes the principal Uses thereof to be the farther Preparation of the Chyle, its more accurate Mixture with the Blood, and its Conversion into a nutritious Juice proper to repair the Decays of the Body.

Borelli takes the great Use of *Respiration*, to be the Admission, and Mixture of Air with the Blood, in the *Lungs*, in order to form those Elastick Globules it consists of; to give it its red florid Colour: and to prepare it for many of the Uses of the animal Economy: But how such Admission should be effected is hard to say.—It is impossible it should be done in the Pulmonary Arteries; nor can it be proved in the Pulmonary Veins.—In Effect, such Communication must be hindered and obstructed by the Air distending the Vesicles, and compressing the Veins in *Inspiration*; and by the slimy Humour that lubricates the Membrane lining the Inside of the *Trachea*; add to this the difficult Passage of Air through such small Pores as will admit Water; and the ill Effect Air ordinarily has, when admitted into Blood.

Other Autho-rs, as *Sylvius*, *Etmuller*, &c. take the great Use of *Respiration*, to be by the Neighbourhood of the cold, nitrous Air, to cool the Blood coming reeking hot out of the right Ventricle of the Heart, through the *Lungs*; and to act as a Refrigeratory.

Mayow and others, assert one grand Use of *Respiration* to be, to throw off the fuliginous Vapours of the Blood along with the expelled Air; and for *Inspiration*, he asserts, that it conveys a nitro-aerial Ferment to the Blood, to which the animal Spirits, and all muscular Motions are owing.

But Dr. *Thurston* rejects all these, from being principal Uses of *Respiration*, which he shews to be, to move or pass the Blood, from the right to the left Ventricle of the Heart, and so to effect the Circulation.

He instances an Experiment made by Dr. *Croon* before the Royal Society, who by strangling a Pullet, so as not the least Sign of Life appeared; yet by blowing into the *Lungs*, through the *Trachea*, and so setting them a playing, he brought the Bird to Life again.—Another Experiment of the same Kind is that of Dr. *Hook*, who after hanging a Dog, cut away the Ribs, *Diaphragm*, and *Pericardium*, and also the Top of the Wind-pipe, that he might tie it on to the Nose of a Pair of Bellows; and thus by blowing into the *Lungs*, he restored the Dog to Life; and then ceasing to blow, the Dog would soon fall into

into dying Fits, but recover again by blowing, and thus alternately, as long as he pleased.

The only Animal exempted from this Necessity of breathing, is a *Fetus*; but this while included, in the Womb, seems to have little more than a vegetative Life, and ought scarce be reckoned among the Number of Animals; it is rather a Graft on, or Branch of the Mother.

The Neck, (which being nothing else but an Extension of the *Thorax*, we'll examine in this Place) commences at the *Atlas*, which is the first *Vertebra*, next to the Head, and terminates at the first *Vertebra* of the *Thorax*.—It has the Length of seven *Vertebrae*, and is not so broad as it is long.—Its Fore-part is called the Throat, and the Back-part the *Nucha*, or Nape.—'Tis divided into the containing Parts, which are the same with those of the whole Body; and the contained, among which the *Trachea*, the *Larynx*, and *Œsophagus* are of the greatest Note.

(HH) The *LARYNX* is the principal Organ of the Voice, and the upper Part of the *Trachea*, placed on the Fore-Side of the Neck, directly in the Middle.—Its Figure is circular.—It rises before, and is flat behind, to prevent its hurting the *Œsophagus* just placed under it. This Rising is called *Adam's Bit*, upon the ridiculous Opinion that the forbidden Fruit stuck in his Throat, and so occasioned a Bunch.

The Magnitude of the *Larynx* varies according to the Difference of Ages. In young Persons 'tis strait, and renders the Voice shrill; in Persons of riper Years 'tis larger, and renders the Voice strong.—'Tis bigger in Men than in Women.—It does not appear so visibly in Women as in Men, because the Glands of the lower Part of the *Larynx* are larger in Women, and thereby their Neck becomes rounder, and their Throat fuller.—It moves in Deglutition, for when the *Œsophagus* lowers itself, to receive the Food, the *Larynx* rises to press it down.

The *Larynx* consists of Cartilages, Muscles, Membranes, Vessels, and Glands.

The whole Body of the *Larynx* is formed of five Cartilages, viz. the *Thyreoides*, *Cricoides*, *Arytenoides*, the *Glottis* and *Epiglottis*.

The *Thyreoides* is hollow within, and Convex without, and divided in the Middle by a Line, which give Occasion to say 'twas double, though 'tis very rarely found to be such.—The *Larynx* is square, and each of its Angles has a Production.—The two upper Productions are the longest, and are tied to the Sides of the *Os Hyoides* by a Ligament; and by the two lower Productions to the *Cricoides* Cartilages.

The *Cricoides* resembles a Ring, and goes round the whole *Trachea*.—'Tis narrow before, but broad and thick behind.—It serves for a Basis to all the other Cartilages, and joins them all to the *Trachea*, and for that Reason is immovable.

(L) The *Ærythænoides*, which is the third Cartilage, is placed in the *Thyreoides*, and supported by the annular Cartilage.—It forms the back Part of the *Larynx*.

(M) The *Glottis* forms the upper and back Part of the *Larynx* where 'tis narrowest, and renders the Voice either shrill or strong, according as it contracts or dilates itself.

(N) The *Epiglottis* serves for a Cover to the *Glottis*.—It resembles an Ivy-Leaf, and has a softer Substance than any of the other Cartilages, which qualifies it to rise, or lower itself commodiously.—'Tis fasten'd to the concave and upper Part of the *Thyreoides*.—The Orifice of the *Larynx* stands always open for *Respiration*, except when the *Epiglottis* shuts it. Now the Weight of the Aliment makes the *Epiglottis* fall down upon it, least any Thing should fall into the *Trachea*; but as soon as the Aliment is pass'd the *Œsophagus*, or Gullet, the *Epiglottis* recovers itself by a natural Rebound, in Order to afford a Passage to the Air.

The *Larynx* is provided with fourteen Muscles, seven on each Side, which dilate or contract the Wind-

Pipe, or *Trachea*, upon Occasion.—Of the fourteen, four are common, and ten are proper.—The Common are inserted in the *Larynx*, but rise elsewhere; The Proper have both their Origin and Insertion from it.

(OO) The two first Common proceed from the upper and lower Part of the first Bone of the *Sternum*, and mount along the Cartilages of the *Trachea*, till they arrive at the lateral Part of the *Thyreoides*, where they are inserted.

The two other common Muscles proceed from the Fore-Part of the *Hyoides* Bone, and are inserted in the outer and lower Part of the *Thyreoides*.—They serve to raise the *Larynx*, by contracting the upper, and dilating the lower Part of the *Thyreoides*.

The first Pair of the proper Muscles proceed from the lateral and Fore-Part of the *Cricoides*, are inserted in the lower Part of the Wing of the *Thyreoides*, and therefore placed in the fore and lateral Part of the Wind-Pipe.

Of the remaining four Pair, two serve to open the *Larynx*, and two shut it.

The first Pair employed in opening the *Larynx* proceed from the lower and back Part of the *Cricoides* Cartilage; and are inserted into the upper and hinder Part of the *Ærythænoides*.

The next Couple for the same Use, take their Origin from the Edge of the lateral and upper Part of the *Cricoides*, and their Insertion from the lateral and upper Part of the *Ærythænoides*.

The first Pair that serve to shut the *Larynx* spring from the hinder and lower Part of the *Ærythænoides*, and have an oblique Insertion in the same Cartilage.

The second Couple, for that Use, proceed from the hollow and inner Part of the *Thyreoides*, and terminate in the Fore-Part of the *Ærythænoides*.

The *Larynx* has two Membranes; an outer one, which is continuous with the outer Cover of the *Trachea*; and an inner one, which is the same with that of the Palate, for it lines the whole Mouth, and descends as an inner Coat through the *Pharynx*, the *Larynx* and the *Trachea*.

It receives two Branches of Nerves from the Recurrents; and is moistened by four large Glands, two situate above, called *Tonsils*, and two underneath, called *Thyroidea*.

The *Tonsils* are of a spongy Substance, seated on each Side the *Uvula*, near the Root of the Tongue. The common Coat of the Mouth is their Cover; their Nerves are derived from the fourth Pair; their Arteries from the *Carotides*, and their Veins unload in the Jugular.—These Glands are frequently liable to Abuses, which ripen easily by Virtue of the Heat of the Mouth.

These Glands serve to make a Secretion of the Blood imported by the *Carotides*. This Serum they unload in the Bottom of the Mouth, in Order to keep the Wind-pipe moist, and Part of it trickles down the *Trachea*.

The two lower Glands called *Thyroidea*, are placed under the *Larynx*; by the annular Cartilage; and the first Ring of the *Trachea*; one on each Side; they have the Figure of a little Pear. Their Substance is more solid, viscous, and inclining to a muscular Consistence than that of the other Glands.—Their Nerves are from the recurrent Branches; their Arteries from the *Carotides*; their Veins run to the Jugular, and their Lymphatick Vessels unload in the Thoracic Duct.

These Glands make a Secretion of a viscous Humour, with which the *Larynx* is done over, in Order to facilitate the Motion of its Cartilages, to qualify the Acrimony of the *Saliva*, and to soften the Voice.

The *Larynx* is of a very considerable Use, not only in modulating and softening the Voice, by the different Apertures of its *Rima*, or Chink, but also in compressing the *Lungs* to a greater or less Degree by the Air; for if the internal Diameter of the *Larynx* had been equal to that of the *Trachea*, the *Lungs* could have undergone little or no Compression at all;

nor consequently without the *Larynx* could we have reaped the Advantage from breathing, in regard the Air would not have resisted that Force wherewith it is driven out in Expiration, nor consequently could the Compression have been made in the Lungs, which is found necessary for the Comminution of the Globules of the Blood; and the mixing of the two Fluids, Air and Blood together.

2. Behind the *Larynx* there is a very large Cavity, called the *PHARYNX*, which is only the Orifice of the *Œsophagus*, dilated to a great Extent.—'Tis made like a Funnel, and some call it *Gula*, or Gullet, in which the Action of Deglutition commences, and where it is chiefly performed.

It is assisted by three Pairs of Muscles, which chiefly compose the *Pharynx*.—The first, called the *Stylopharyngeus*, serves to draw up and dilate the *Pharynx*. The second, *Pterygopharyngeus*, serves to constringe it; the third, which is called the *Œsophagus*, serves to close it.

The Office of the *Pharynx* consists in receiving the Aliment into its widest Part, and conveying through its narrower Passage into the *Œsophagus*, which conducts it to the Ventricle; and which is performed in the following Manner. When the Muscles heretofore mentioned have widened the *Pharynx*, then the *Œsophagus* contracting itself, raises the *Larynx*, and presses down the *Pharynx*, which clings round the Aliment on all Sides, and obliges it to descend thro' the *Œsophagus* into the Ventricle.

The *ŒSOPHAGUS*, or *Gullet*, is a membranous Pipe or Passage, whereby our Food and Drink is conveyed from the Mouth to the Stomach.

The *Œsophagus* descends from the *Fauces* to the Stomach, between the *Aspera Arteria* and the *Vertebrae* of the Neck and Back, in a strait Line, excepting for a little Deflection about the fifth *Vertebra* of the *Thorax*, where it turns a little to the Right to make Way for the great Artery, which runs along with it to the Ninth; where turning again towards the left, it crosses the Artery, and piercing the Diaphragm, ends at the left Orifice of the Stomach.

It consists of three Membranes, which qualify it for an easy Dilatation upon the Swallowing of a Bone, or an ill-chewed Morfel.—Of these three Membranes the outer one is a Continuation of that which invests the Stomach.

The first proper or middle one is carnosus, thick, and soft like a Muscle, and is possessed of round and oblique Fibres, which effect the Motion of the *Œsophagus*.

The second proper is nervous, and contiguous with that, which invests the Mouth and Lips, by which means it comes to pass that the Lips tremble, when a Vomiting approaches. This Coat has long and strait Fibres, and like that of the Stomach, is strewed with an Infinity of Glandules, which strain out an acid Humour into the *Œsophagus*; and this Humour gliding to the Bottom of the Stomach, affects it with the Sense of Hunger.

M. Duncan observes, that when any acid Vapours proceeding from the Stomach, irritate the nervous Membrane of the *Œsophagus*, by provoking the Spirits to crowd particularly to that Part, it never misses to make us yawn, and therefore this Membrane is the true Seat of yawning; for in that Case, the nervous Fibres of the inner Membrane swell by the Irritation; and by dilating the *Œsophagus*, oblige the Mouth to answer their Motion, it being lined with the same Membrane.

The *Œsophagus* receives Nerves from the *Par vagum*; Arteries from the *Aorta*, and *Celiaca*; and two Sorts of Veins, one above, which runs to the *Azygos*, and another below, which terminates in the stomachick *Coronaria*.

The Glands placed at the hinder Part of the *Œsophagus* serve to separate the viscous Humour with which its Cavity is moistened, and rendered more slippery in order to facilitate the Descent of the Aliment.

The Action of the *Œsophagus* belongs to the animal Class, and not to the natural, for it is effected by the means of the Muscles, and Swallowing is known to be a voluntary Action.—Its Motion is of Undulation, like that of the Intestines, and is performed by the oblique and circular Fibres of its fleshy Membrane.—When this Motion tends from above downwards, 'tis called *Peristaltick*, and the Reverse of that *Antiperistaltick*.

From the *Neck* we proceed to the Parts contain'd in the Head, since we have already given, in the *Osteology*, an entire and full Description of the containing ones.

The first Part that offers itself to our View after the lifting up of the Skull, is the *DURA MATER*, which consists of a double Plan of Fibres, that cross one another a thousand different ways; though sometimes one may divide it into two very easily.—'Tis much thicker in young Persons, and sticks very close to the Skull, by a great many little Vessels, which nourish the inner Part of the *Cranium*; of which this Membrane is thought by many Authors to be a Continuation.

Arteries and Veins rise above the outer Surface of the *Dura Mater*, and so contrived that the Arteries are always covered with Veins to prevent any Injury accruing to the *Cranium* from the continual Pulsation of the Artery.—The Arteries of the Brain proceed from the inner *Carotides*, and those of the *Cerebellum* from the *Vertebrales*.—The Veins of the Brain empty themselves into the inner jugular Veins, and those of the *Cerebellum* into the Vertebral.—In these Vessels there are mutual *Anastomoses* of Arteries with Arteries, and Veins with Veins, to the end that the Blood being stopt on one side, the Brain may be sufficiently supplied on the other.

To prevent the Compression of the Vessels, Nature has run the Vertebral Artery through a bony Gutter, digged out of the transversal Processes of the Neck, and conducted the same Artery to the *Cranium*, by the *Foramen* of the *Occiput*, where it is defended from Pressure by being laid in a hollow Cut of the first *Vertebra* of the Neck.

'Tis to be observed, that some Arteries run off obliquely, after they have gone some Rounds upon the *Dura Mater*, to mitigate the boiling of the Blood, which otherwise would occasion grievous Head-achs.—These Arteries unload in the longitudinal *Sinus* of the *Dura Mater*, which does not happen in any other Part of the Body; for the Blood of the Arteries never mingles elsewhere with that of the Veins, without passing first through some Glands, or the Fibres of some Parts.—In effect the Veins have no immediate Communication with the Arteries in any other Part of the Body; and perhaps, 'tis allowed of here, to render the Blood in the *Sinus*'s very liquid; for being as it were extravasated and robbed, not only of its finest and subtlest Part in the Glands of the Brain, but even of all its *Serum* in the Glands of the *Plexus Choroïdes* would readily congeal, if it was not quickened and inspired with fresh Warmth by the arterious Blood.

The *Dura Mater* invests the whole Substance of the Brain and *Cerebellum*; serves, 1. To keep the Brain from rattling against the Skull in the great Commotions of the Head; 2. To let in the more volatile Parts, which are perpetually evaporated from the Brain; 3. To fill up and stop the Holes of the Skull through which the sanguine and nervous Vessels pass; and, 4. For a Cover to the Nerves, and defends them from being annoyed by the Hardness and Roughness of the Skull in passing through its Perforations.

This Membrane is endowed with an exquisite Sense, independent from the Brain, for if the Brain is stript of the *Dura Mater*, it might be cut without Pain.—This Sense proceeds from its immediate Contact and Union with the Nerves, to which 'tis a Cover, and from some Threads it receives of the fifth Pair of Nerves, at the Place of its Perforation.

In that Part which runs out in length under the *Sagittal Suture*, the *Dura Mater* is double, and by a gradual Diminution enters the Substance of the Brain. This Duplicature contracting itself, marches from the *Cerebellum* to the Fore-part of the Head, and is fastened to the hollow Part of the coronal Bone above the *Crista Galli*.

(D) This Duplicature is called *FALX*, from the Resemblance of a Sickle.—This Membrane has another Duplicature towards the *Lamboides Suture*, where 'tis four times thicker, than in other Places, the better to part the Brain from the *Cerebellum*; besides dividing the Brain by its Length into its left and right Side, to keep one side from pressing the other (when one lies on one side of the Head) to keep up the second longitudinal *Sinus*, and to hinder the Corruption of one Side to be imparted to the other; from whence it happens, that one Side may be sound, while the other is spoiled.

The second Duplicature of the *Dura Mater* serves to guard the *Cerebellum*, from the Pressure of the two hinder Lobes of the Brain, and to keep up the two lateral *Sinus's* in savage Animals.—In this Place called the *Torcular*, or Press, there stands a bony Protuberance which fortifies the last Use of the Duplicature.

The *Dura Mater* presents us with ten *Sinus's* or Cavities, *viz.* (E) the superior Longitudinal; (FE) the two Lateral; (G) the Streight; (H) the inferior Longitudinal; one at the Crift of the *Os Occipitis*, and two upon the stony Process, one above and another below, which communicate with one another towards the *Sella* of the Wedge-like Bone, and after that communicate with those of the other Side towards the hinder *Clinoides* Processes.

The upper longitudinal *Sinus* runs upon the *Falx*, along the sagittal Suture, and terminates together with the *Falx* above the *Crista Galli*. The lateral Cavities commence towards the *Lamboides Suture*, where the *Falx* and the back longitudinal *Sinus* take their Rise. The streight *Sinus* commences towards the Union of the lateral, or the Division of the upper longitudinal, and marches streight to the *Glandula Pinealis*.—The lower longitudinal runs along the Extremity of the *Falx*, and terminates the streight *Sinus*.

The Cavity that lies by the Crift of the *Os Occipitis*, extends no further than the Crift, and disembogues in the lateral *Sinus's*; the other Cavities in the Base of the *Cranium*, all empty themselves into the lateral *Sinus's*, some higher, and some lower, and commonly at that Place, where they wind in the Form of a Roman S, and then unload in the jugular and internal vertebral Veins.

These ten Cavities serve to contain the Blood in the Brain, for some Time, in order to heat it, by their moderate and cherishing Heat, for the Generation of animal Spirits, and to check its rapid Course, they serve also to receive the Residue of the Blood from the Capillary Veins of the Brain, and convey it to the jugular and vertebral Veins, in order to Circulation.

The *Dura Mater* has a Motion of *Diastole*, and *Systole*, which is caused by the Arteries which enter the Skull.

(I) The *PIA MATER* lies immediately under the *Dura Mater*, and is a fine, thin Membrane, which covers the Brain so intimately, that it can scarcely be separated from it; it accompanies the Brain in all its Circumvolutions; and conducts all the Vessels that either enters its Substance, or depart from it.

Dr. *Willis* observes, that 'tis filled with a great many little Glands, which serve to separate a watery Humour that moistens the two Membranes.—'Tis alledged that this *Pia Mater* is extream sensible, and the Seat of the Head ach.

(M) Under the *Meninges* appears a large, soft, whitish Mass, wherein all the Organs of Sense terminate, called *BRAIN*.

Its Figure is the same with that of the Bones that

contain it, *viz.* roundish, oblong, and flat on the Sides: It is divided into three principal Parts, *viz.* the *Cerebrum*, or Brain, strictly so called, the *Cerebellum*, and the *Medulla oblongata*.

The *BRAIN* is divided by the *Falx*, into two equal Parts, called right and left *Hemispheres*; though the Figure of the *Brain* be pretty far from a Sphere. It is also separated from the *Cerebellum*, by another Duplicature of the *Dura Mater*.

(N) It consists of two Kinds of Substance; the one Cineritious, or Ash-coloured, soft and moist; which, being Exterior, is also called the *Cortex*, or cortical Part of the Brain: The Thickness of this is about half an Inch, though by Reason of the *Sinus's*, and *Sutures* in the Brain, it appears more.—The other or inner Substance is white, more solid, as well as more dry than the *Cortex*, and is called the *Marrow*, or *Medullary*, and sometimes the *fibrous* Part, in Contradistinction to the other, which is also called the *glandulous* Part.

The *Cortex*, according to *Malpighi*, is formed from the minute Branches of the *Carotides* and vertebral Arteries; which being woven together in the *Pia Mater*, sends from each Point thereof, as from a *Basis*, little Branches, which being twisted together into the Form of a Gland, inclose the *Medulla*, ordinarily to the Thickness of half an Inch; but in some Places make deeper *Sinus's*, and Furrows within it. These little Branches make Circumvolutions like the Intestines; each of which may be resolved into others, like, but less than the first.

(Δ) This Part, therefore, most Authors take to be glandulous; or an Assemblage of innumerable minute Glands, contiguous to each other, destined for the Secretion of animal Spirits from the Blood, brought hither by the *Carotides*, &c.

Dr. *Willis* alledges, that these Glands serve likewise to filtrate the nervous Juice, which is an oily, and very subtil Liquor, affording a Vehicle to the animal Spirits, and assisting the Blood, in the Nourishing of the Parts, as it appears from the Arms and Legs of Paralitick Persons, which dwindle, and grow meagre for Want of that Juice.

(O) The inner or medullary Part of the *Brain*, consists of infinitely fine Fibres, arising from the minutest Branches or Filaments of the Glands of the *Cortex*; as is distinctly seen in the *Cerebellum*, tho' scarce visible in the *Cerebrum*: These receive the Fluid separated and subtilized from the Glands of the *Cortex*; and by Means of the Nerves, which are no more than Productions of this Part, distribute it all over the Body.

Authors here, however, are divided; the Generality, with *Malpighi*, making the Substance of the *Cortex* glandulous, as above; others with *Ruyfch*, and *Leeuwenhoek*, deny any Thing like Glands in it; and allow nothing but little *Cryptae*, or Sinks, opening laterally to the Arteries; and thence receiving a Juice already screened from the Blood, and transmitting it to the *Medulla*.

In the Space between the two Hemispheres of the *Brain*, under the *Falx*, or rather under the longitudinal *Sinus* of the *Dura Mater*, is a white Substance, of a Texture, more compact than the *Medulla* of the *Brain*, called *Corpus Callosum*, which runs along the whole Tract of the *Falx*, and receives from each Side the Terminations of the *Medulla*, interspersed between the several Windings of the *Cortex*, and supposed by some to be a Kind of Base, or Support to it.

(QQ) Under the *CORPUS CALLOSUM*, there are two great Cavities, called by some, the superior, or anterior Ventricles, and by others, lateral, tho' they have one besides, on each Side of them. Both these Cavities are of the same Magnitude and Figure; and their Situation and Uses are likewise the same.—They begin from a narrow Point towards the Root of the Nose, and enlarging by Degrees, form each of them a great Cavity towards the End; by which

which Means they are larger towards the lower, than towards the upper Part of the *Brain*.

They are seated in the Middle of the *Brain*, being equally distant from the *Os Frontis*, and the *Os Occipitis*; and their Distance from the Bottom of the *Cranium*, is very near the same with that from the Crown of the Head.

These two *Ventricles* are parted by a very fine Portion of the medullary Substance, enclosed between two Membranes, or Continuations of the *Pia Mater* (wherewith the Inside of these two *Ventricles* is lined) called, from its Transparency, *Septum lucidum*.

(RR) The *CORPORA STRIATA* (called thus from their Streaks or Furrows) are two considerable Eminences, of a browner Colour, than the rest, there being one in each *Ventricle*.

Dr. *Willis*, under Pretence that the great Number of Channels or Gutters, which run like Skrews in this Place, were dug out by the Impression which the Soul receives from Objects, is supposed to have made it the principal Seat of that noble and mental Part of ourselves.

(S) The *INFUNDIBULUM*, which is a Cavity in the Form of a Funnel, descends to the *Basis* of the *Brain*, and terminates with a Point in the *Glandula Pituitaria*, is formed of the *Pia Mater*, and placed in the Middle of these *Ventricles*.

The ancient Anatomists pretended, that the animal Spirits received their last Degrees of Perfection in these *Ventricles*, as the vital ones were subtilized in the *Ventricles* of the Heart, which *Ventricles* were nothing else but Cisterns, from whence the animal Spirits were sent by the Nerves to all the Parts of the Body, as the vital Spirits are sent from the Heart by the Arteries.

Modern Authors pretend, on the contrary, that these *Ventricles* are rather Cisterns for the superfluous Moisture of the *Brain*, than a Place of Nativity for the animal Spirits; alledging that the animal Spirit is too subtil, not to slip out through the Holes that answer the *Crista Galli*, or the Arches of the *Fornix*, that go to the third *Ventricle*, without mentioning the Serosity of which these *Ventricles* are commonly full, the Situation of the *Infundibulum*, which is placed in their Middle, and serves them as a Sink, and the *Glandula Pituitaria*, placed immediately underneath, in Order to receive the Serosity.

Monsieur de la Cambre is of Opinion that the *Ventricles* were formed only to facilitate the Motion of the *Brain*, which could not perform its Functions, if its whole Body was full and solid, since it is like Bellows, which can never enlarge their Cavity without a Vacuum in their Sides.

(T) That which appears red in each of these *Ventricles*, is Part of the *Plexus Choroïdes*; more of which hereafter.

The *FORNIX* is a Production of the *Medulla*; which at its Extremities next the *Cerebellum*, sends out two Processes, by whose Juncture is formed a Kind of Arch, thence called *Fornix*, which separates the third *Ventricle*, from the two upper ones—At the Bottom of the *Fornix* are two Holes, by which the third *Ventricle* has Communication with the others; that before, is called *Vulva*, and that behind, *Anus*.

(V) The *THIRD VENTRICLE*, or *Rima*, which is in the *Medulla Oblongata*, has likewise two Apertures; the one the Orifice of the *Infundibulum* or Funnel; the other is a Duct, whereby the third *Ventricle* communicates with the fourth, in the *Medulla Oblongata*, under the *Cerebellum*.—The whole Cavity of the third *Ventricle* is filled with the *Plexus Choroïdes*, which is an Assemblage of minute Veins and Arteries; and four Eminences, the first the *Corpora Striata*; the others the *Thalami Nervorum Opticorum*.—Some believe this Assemblage or Texture, to be like a Water-bath to the *Brain*, which by its gentle Heat, preserves the Motion of the Spirits in the *Corpus Callosum*.—Others alledge, that the

Heat of this Texture, keeps up the Liquidness of the *Serum* in the *Ventricle*, which without the warm Influence of its numerous Vessels would thicken and condensate; so that it hinders the Humours from Stagnating, and causes Obstructions in the *Infundibulum*.

(X) At the Entrance of the Canal, reaching from the third *Ventricle* to the fourth, is situated the *PINEAL Gland*; so called from the Figure of a Pine-Apple, which it resembles.——This Gland *Des Cartes* supposes to be the Seat of the Soul, though, in my Opinion, the Soul is not confined to any Part, but is present wherever it acts, after the Manner of the Spirits, which have no Ubiquity; so that 'tis ridiculous to place it, with *Empedocles*, in the Heart; or, with *Van-Helmont*, in the Stomach or Spleen; or in the *Brain*, with the greatest Part of Philosophers, who after all are not agreed, whether its Residence extends to the whole *Brain*, or only to one Part of it. Therefore I may venture to advance, that the Soul is *Tota in Toto*, and *tota in quâlibet Parte*, i.e. That it is entire in the whole Body, and entire in each Part.

The Use of the *Glandula Pinealis*, is to separate some Liquor (as well as the other Glands) in order to be thrown into the *Ventricles* of the *Brain*.

Behind the *Pineal Gland* are four Eminences; two upper and greater, called *Nates*; and two smaller, and lower called *Testes*.

(YY) The *CEREBELLUM* is the hind Part of the *Brain*, and esteemed a kind of little *Brain* by itself. It is placed in the hinder and lower Part of the Skull, underneath the hind Part of the *Brain* or *Cerebrum*: It lies open to the *Cerebrum* at Bottom; but is separated from it at the Top by a Duplicature of the *Dura Mater*; its Figure somewhat resembles a flat Bowl, broader than long.

Duncan remarks, that 'tis formed by two Branches, which setting out from the Sides of the Trunk of the *Medulla Oblongata*, make a Sort of Cradle, by joining in the Middle, and leaving between them a Cavity, called the fourth *Ventricle*.

Its Substance is harder, drier, and more solid than that of the *Brain*, but of the same Nature and Kind, being composed like it of a cortical, or glandulous, and a medullary Part; the Branches of which last, when opened, resemble those of a Tree, meeting in the Middle, and forming a Kind of Stem, which runs quite through it. Its Colour is yellowish, that of the *Brain* whiter.

Its Surface is unequal, and furrowed, but not so much as that of the *Cerebrum*; appearing rather as if laminated, like some Shells; the middle Circles being the largest, and deepest: Between the *Laminae* are Duplicatures of the *Pia Mater*. The fore and hind Parts of the *Cerebellum* are terminated by *Apophyses*, called *Vermiformes*, from the Resemblance they bear to Worms. It is joined to the *Medulla Oblongata*, by two Processes, called by *Willis* *PEDUNCULI*.

Besides these are two or three other medullary Processes, which passing a-cross the *Medulla Oblongata*, form an Arch; from the Discoverer, called *Pons Varolii*.

Those who took the animal Spirits to be formed in the *Ventricles* of the *Brain*, gave this Part the Title of Noble; upon the Apprehension that it raised the Spirits to the last Degree of Perfection, and dispersed them through the whole Body, by Means of the spinal Marrow.

The Blood Vessels of the *Cerebellum* are the same with those of the *Cerebrum*, and its Use the same, viz. to separate the nervous Juice from the Blood, and convey it through the several Parts of the Body.

Dr. *Willis*, however, distinguishes between the Functions of the *Cerebrum* and *Cerebellum*, making the first the Principle of voluntary Motions, and Actions; and the last the Principle of involuntary ones, viz. that of Respiration, the Motion of the Heart, &c.

It is commonly asserted that a Wound, either in the *Cortex*, or the *Medulla* of the *Cerebellum* is mortal,

tal, which it is not in the Brain, from which there have been entire Parts taken away, without Harm; the Truth is, we have Instances of People living, not only without *Cerebrum*, but also without any *Cerebellum*.

We have a History from *Paris* of a Child delivered at Maturity, and living four Days, not only without *Brain*, but even without a Head; instead of both which, was a Mass of Flesh like Liver.

Mr. *Dennis* gives another Instance of a Child born in 1673, which, setting aside the Head, was well formed, but without any *Brain*, *Cerebellum*, or *Medulla Oblongata*: It had not any Cavity for a *Brain*, the Skull, if such it might be called, being solid; nor was this any Ways connected to the *Vertebrae*; so that the Marrow in the Spine had no Communication with the Head: The Optic Nerves terminated in the solid Bone.

Mr. *Le Duc* gives a third Instance in 1695, where there was neither *Cerebrum*, *Cerebellum*, *Medulla Oblongata*, nor even spinal Marrow; the Cavity that should contain them being extremely shallow, and full of a black livid Substance, like congealed Blood: He adds, this was the third Subject of the Kind he had met with.

Dr. *Preston* tells us, that M. *Du Verney* found here a spinal Marrow, though of much less Consistence than ordinary: In which, however, he could distinguish all the four Tunics, and the two Substances, viz. the cortical and fibrous Part, as in the Brain.

By turning up the *Brain*, the Origins of the Nerves proceeding from it are distinctly seen; these are in Number ten Pair, viz. the olfactory, optic Movers of Eyes, Pathetic; the fifth Pair and sixth Pair, called also the *Gustatoriae*, the auditory Nerves, *Par Vagum*, and the ninth and tenth Pair.

The OLFATORY NERVES proceed from the *Basis* of the *Corpora Striata*, by a medullary Fibre, which is largest in that Place, where they fetch a winding Turn near the optic Nerves.

The OPTIC NERVES rise from the Extremity of the *Corpora Striata*, and the medullary Part, called *Talami Nervorum Opticorum*. After gradual Approaches, they unite above the *Sella* of the Wedge-like Bone; and afterwards divide into two Strings, which repair to the Eyes.

These Nerves are surrounded with small Branches of the *Motors*. As the Carotide Arteries enter the Brain, they run along the Trunk of the optic Nerves, whence Dr. *Willis* infers, that after eating, these Arteries being then fullest of Blood, cause Sleep by pressing down the optic Nerves.

The MOTORES, or Movers of the Eyes, proceed from the *Basis* of the *Medulla Oblongata*, near the *Infundibulum*, pass through a Hole under the optic Nerves, divide into four Branches, which are distributed to the Muscles of the Eyes, and the Eye-lids, and oftentimes disperse likewise a Branch to the *Crotaphites* Muscle, which occasions its Communication with the Eyes.—The *Carotides* Arteries, and the *Infundibulum*, lie between these Muscles.

The PATHETIC rises from the lower Part of the *Medulla Oblongata*; behind the *Nates* and the *Testes*.—They divide into four Branches, one of which visits the great oblique Muscle; the second the upper Lip, the Nose, and the Gums; the third, the Membrane of the Nostrils; and the fourth, the *Crotaphites*.

The FIFTH PAIR, which is bigger than all the rest, commences from the Sides of the annular Protuberance behind the *Pathetici*, and divides into three Branches, viz. the *Ophthalmic*, the *Maxillaris Superior*, and the *Maxillaris Inferior*.

The OPHTHALMIC, so called from its repairing to the Eyes, after detaching several Threads, which surround the optic Nerves, and are distributed to the *Carotides*, divides into two Branches; the biggest of which is subdivided into two, viz. one that marches out by a Hole, called the outer Orbital, and another which passes through the Hole of the Eye-brows, and

is lost in the Muscles of the Forehead, the great orbicular Muscle of the Eye-lids, the Lachrymal Gland, and the Nose-bag. The last Branch passing through the Orbital Foramen, is lost in the Membranes of the Bony *Laminae* of the Nose. The upper Maxillary Nerve is distributed to the upper Part of the Teeth, as the lower Maxillary to their lower Part.

The SIXTH PAIR, improperly called *Gustatoria* (since it does not run to the Tongue, but to the Eyes, as well as the *Motors*, *Pathetici*, &c.) rises by the last Pair, in the lower Part of the annular Eminence, marches out of the Skull by the same Hole with the third and fourth Pair, and is distributed upon the Muscle of the Eye, called *Indignatorius*, after having sent out a small Branch, which, together with two Branches of the fifth Pair, forms the intercostal Nerves.

The INTERCOSTAL is bestowed upon the Heart, the Breasts, and the Privy Parts. By this mutual Communication Dr. *Willis* explains several *Phaenomena*, viz. the mutual Pleasure that affects Lovers in their Caresses and reciprocal Kisses. Sometimes the Intercostal is formed only by the sixth Pair.

The Intercostal receives in its first *Plexus* the tenth Pair, with a Branch from the first vertebral Nerve of the Neck, that's united with the tenth Pair; and another Branch from the second Vertebral of the Neck; at last there springs from this *Plexus* a Branch that serves the Head of the *Trachea*. As soon as it arrives under the Channel-bone it forms a second *Plexus*, which sends out two Twigs, which embrace the axillary Arteries in the Form of a Ring, from whence proceeds a third *Plexus*, formed by the Junction of the Intercostal, with several Branches of the *Bronchiales*, and *Dorsales*, that descends along the *Vertebrae*.

Of the Productions of this Nerve, in Conjunction with others from the eighth Pair, are formed the *Nervi Cardiaci*; and those of the Lungs; and of three other Productions which join together in one Trunk, before they enter the *Abdomen*, are formed, likewise, the hepatic *Plexus* on the Right, and the *Splenic* on the left Side.

From the Hepatic *Plexus* there spring several Branches, some of which cross over the *Duodenum*, and the *Vena Porta*, and repair to the Liver; some run to the *Pancreas*, or Sweet-bread, and to the right Side of the Stomach; and others to *Glisson's Capsula*; and two larger than the former pass over the emulgent Artery, and run to the right Kidney.

The Splenic *Plexus* furnishes several Branches to the left Side of the Stomach and *Pancreas*, some to the Spleen, and the left *Capsula Atrabilaria*, and two very considerable Branches to the left Kidney.

From the several Branches both from the Hepatic and Splenic, is formed the Mesenterick *Plexus*, which serves as a Cover to the Mesenterick Arteries, and accompanies them thro' their whole Distribution.

Further, there is a Trunk on each Side formed out of several Branches, both from the Hepatic and Splenic *Plexus*, which descending along the *Aorta*, continues its Course, accompanied with the Twigs of the Intercostal, to the Division of that Vein. This done, 'tis dispersed thro' all the Parts of the *Hypogastrium*, particularly the *Rectum*, or strait Gut, the Bladder, the Womb and the *Vagina* (in Women) and the Male seminal Vesicles and *Prostates*.

At last the Trunk of the Intercostal descending along the *Vertebrae*, is lost in Capillaries dispersed thro' all the Parts of the *Hypogastrium*, particularly the Bladder, the *Anus*, the *Rectum*, and the Genitals.

The AUDITORY NERVE, proceeds from the lower Part of the annular Rising, and passes through the Perforation of the stony Process of the Temple-bone.—This Nerve is composed of two Branches, one soft, which serves the immediate Organ of hearing, and forms the nervous Membrane which cover the *Cochlea*, and the inner Side of the semicircular Passages; and the other hard, which marches out thro' a Hole

a Hole that lies between the *Mastoides* and *Styloides* Processes, and goes to unite with the third Branch of the *fifth Pair*.

The *PAR VAGUM*, so called from its serving so many different Parts, proceeds from the Sides of the *Medulla Oblongata*, and lies behind the *Acoustici*.—To this is joined another Nerve, rising from the spinal Marrow, called accessory by Dr. *Willis*.—These two Nerves march out with joint Forces through the Perforation of the *Os Occipitis*, but as soon as they are out of the Skull, the spinal Parts from the *Eighth Pair*, and is quite spent upon the *Trapezium* Muscle.

The *Eighth Pair* is no sooner departed from the Skull, but it forms a *Plexus*, as well to supply the *Larynx* and *Pharynx* with its Branches, as to produce the recurrent Nerve. The right Branch whereof encompasses the axillary Artery, as the left does the *Aorta*.—These two Nerves return upwards by the Sides of the *Aspera Arteria*, and send forth Shoots to the Fibres that fasten the *Annuli*.

The *Cardiaci* and the *Pneumatici*, are also form'd from the several Shoots which the *Intercostal* and *Eighth Pair* send to the *Pericardium*, the Heart, the Lungs, and the *Cava*.

(9) The *NINTH PAIR* proceeds from several Fibres of the *Eighth*, receives two Branches from the first Vertebral, and one from the second, in its Passage through the Muscles of the Bone *Hyoides*; one of these Branches is dispersed through the Muscles *Sterno-Thyreoides*, and the other spent upon the Muscles of the Bone *Hyoides*.—Its Trunk furnishes the *Basis* of the Tongue with several Branches, and comes to a Period.

(10) The *TENTH* and last *PAIR* proceeds likewise from several Threads, and descends along the Pith of the Back-bone; marches between the first *Vertebra* of the Neck and the *Os Occipitis*, sends Branches to the oblique Muscles of the Head, and in its Progress to the *Plexus* of the *Intercostal*, receives one from the first vertebral Pair.

Duncan observes, that though all the *Nerves* proceed from the *Brain*, yet it may be said to have no Nerves, since not one of them is inserted in it; so that the proper Substance of the *Brain*, which dispenses Sense to the whole Body, is of itself infensible.

(14) The *BASIS* of the *Brain* is no less curious than its other Parts. It has six great Prominences lodged in the six great Pits of the *Cranium*; the four first and anterior are formed by the *Brain*; two of them are lodged in the Cavities of the *Os Frontis*, and the other two in those of the *Offa Petrofa*; the two last and posterior Risings, are placed in the Cavities of the *Os Occipitis*, and formed by the *Cerebellum*.

(aa, bb) The Blood is conveyed into the Brains by the *Carotides*, and servical Arteries, which at their Entrance, form one great Trunk at the *Basis* of the *Brain*, from whence they send an Infinity of Arteries throughout its whole Substance.

(c) The Union of these Arteries serves to mingle the arterious Blood, before its Distribution to the *Brain*, and to check its Rapidity; otherwise it would have made too precipitant a March through the whole *Brain*, and so have baulk'd the Filtration of the *Spirits*.

(Z) *MEDULLA OBLONGATA* is the medullary Part of the *Brain* and *Cerebellum*, joined in one, the Fore-part of it coming from the *Brain*, and the Hinder-part from the *Cerebellum*.—It lies on the *Basis* of the Skull, and is continued through the long Perforation thereof into the Hollow of the *Vertebra* of the Neck, Back, and Loins, though only so much of it retains the Name of *Oblongata* as is included in the Skull.

The Substance of the *Medulla Oblongata* is harder than that of the *Brain*; it rises by four Roots, of which the two greatest spring from the *Brain*, and the other two from the *Cerebellum*.—These Parts

uniting afterwards, are again divided into two, by the *Pia Mater*, whence it happens, that one Side may be paralytick, while the other is sound.

MEDULLA SPINALIS, or the *Spinal Marrow*, is a Continuation of the *Medulla Oblongata*, or medullary Part of the *Brain* without the Skull. It consists, as the *Brain* does, of two Parts, a white, or *medullary*, and a cineritious or glandulous; the former without and the other within.—The Substance of the exterior Part is much the same with that of the *Corpus Callosum*, only somewhat tougher, and more fibrous; which Difference becomes more apparent as it descends the lower, by Reason of the Streightness of the Cavity, which growing gradually more narrow, presses the medullary Fibres closer together, and renders them more compact, and gathers them into more distinct *Fasciculi*, till having descended the whole Tract of the *Spina*, they end in the *Cauda Equina*.—It is the Origin of most of the Nerves of the Trunk of the Body.—It sends out thirty Pair on each Side to the Limbs, the great Cavities, and other Parts, which are nothing but *Fasciculi*, of medullary Fibres, covered with their proper Membranes.

The *Spinal Marrow* is covered with four Coats; the first, or external one, is a strong nervous Ligament, which ties the *Vertebrae* together, to the Inside of which it firmly adheres. The second is a Production of the *Dura Mater*; it is exceedingly strong, and serves to defend the *Spinal Marrow* from any Hurt, from the Flexures of the *Vertebrae*.

The third is a Production of the *Arytanoides*, and is a thin pellucid Membrane, lying between the *Dura* and *Pia Mater*, or the second and fourth Membrane of the *Medulla*.—This Membrane gives a Coat to the Nerves that go out of the *Spina*, which is the inner Membrane of the Nerves, as the *Dura Mater* gives the outer.—The fourth Coat is a Continuation of the *Pia Mater*, and is an extremely thin, fine, transparent Membrane; strictly embracing the whole Substance of the *Medulla*, dividing it in the Middle into two Tracts, and making, as it were, two Columns of it.

The Use of the *Medulla Oblongata*, as well as that of the *Spinalis*, is to give an Origin to all the Nerves; for of forty Pair of Nerves, which march through the whole Machine, ten proceed from the *Medulla Oblongata*, and thirty from the *Spinalis*.

'Tis well known that *SENSATIO FIT IN CEREBRO*, that the *Brain* is the principal Organ of the Soul, and that the Soul makes Use of it in exercising its Functions; but what the Soul is, or where its particular Residence is fixed, we are at a Loss to know; all the Light we have from Anatomy upon this Head amounts to no more than this, that the *Brain* is composed of an Infinity of small Glands, and little *Tubuli* or Pipes; that these small Glands are by their Figure and Disposition qualified to filtrate no Liquor but what is very subtle; and that there are so many Millions of small Pipes, or hollow Fibres, which being formed into Nerves, disperse that subtle Liquor all over the Body.—From whence we conclude, that these Parts are not capable to act of themselves, and that therefore all the Springs of the *Machine* must be put in Motion, by some immaterial Thing called a *SOUL*.

The *FACE*, which is the next to be examined, in the *superior Venter* or *Head*, is divided into two Parts, one above called *Forehead*; and another below, extending from the Eyebrows to the Chin.

The *FOREHEAD* is also called *Front*, from the Latin *Frons*, and from the Greek, *ῥοῦνον*, to think, perceive; of *ῥοῦνος*, *Mens*, the Mind; though *Martinus*, to make out this Etymology, observes, that from the Forehead of a Person we perceive what he is, what he is capable of, and what he thinks of.—*Du Laurens* chuses to derive it from *Ferre*, by Reason it bears the Marks of what we have in our Head.

(A) The Motions of the *Forehead* are performed by

by the Means of two Muscles called *Frontales*, one on each Side the *Forehead*, which spring from the upper Part of the Head, near the Crown; or rather it appears that the *Frontales*, and *Occipitales* Muscles, are only one continued *Digastric* Muscle, on each Side, moving the Scalp, and Skin of the Forehead, and Eye-brows.

The *Frontales* begin to be thus denominated, after they have began to pass the Coronal Suture, with Fibres passing obliquely to the Eye-brows, where they terminate, and in the lower Part of the Skin of the Forehead.

They have each two Appendages; the Superior, or External, is commonly fixed to the Bone of the Nose; the lower is fixed to the *Os Frontis*, and is, by *Volcherus Coiter*, made a distinct Muscle, and called *Corrugator*, from its Use in drawing the Eye-brows to each other.

The Face is divided, as well as the Breast and the Abdomen, into the containing and contained Parts. The former are either common or proper. The common are the Teguments, which are the same with those of the other Parts of the Body. The proper are the Muscles and Bones. The contained Parts are the Organs of four Senses, *viz.* Seeing, Hearing, Smelling, and Tasting; for the Sense of the *Tact*, reaches all over the Body.

The Skin of the Face resembles that of the other Parts, except that it is perforated in four Places, *viz.* the Eyes, Ears, Nose, and Mouth. In Children and Women, 'tis smooth and fine; but in Men, 'tis covered with Hair round the Chin, after the Age of Maturity; insomuch that as Women are privileged with a fair Skin, and with regular and handsome Features, so the Want of that Privilege is made up to Men, by a Majesty and Fierceness, that raise them above the Softness of a Woman.

The Seed and the Beard appearing both about the same Time, is a convincing Proof that there is some Correspondence between them. In Effect, they are both formed of the same Matter, with this Difference, that the subtlest Parts are strained out by the Testicle, form the Body of the Seed, and the coarser being conveyed to the Skin, produce the Beard.—'Tis upon this Account, that those who have the greatest Stock of Seed, are always roughest; and that Eunuchs are without a Beard, as well as without Seed. This Opinion is confirmed by what happens to Women; for we see they have Hairs in the Arm-pits, and the Pubes, at the same Time when they begin to have Seed. 'Tis true, they have no Beard upon the Chin, as Men have, and that must proceed from the Evacuation of the Matter in the menstrual Flux, which attends the Arrival of the Seed: And for a further Proof of this Matter, it is to be observed, that some Women have had Beards upon a Suppression of the Terms.

The Eye is, without Dispute, the handsomest, and most wonderful Part of the Body.—'Tis seated below the Forehead, in a Cavity, called the *Orbita* or Socket, which is all over Bony.—If we consider only its Globe or Ball, its Figure is round; but if invested with its Muscles, 'tis oblong, and pyramidal, throwing its Base outwards, and its Point inwards.

The Magnitude of the Eye varies in different Persons.—A large bulging Eye, is the handsomest; but at the same Time, 'tis not so serviceable as little Eyes, or those which are sunk deeper, for its Perception is not so nice, and 'tis more exposed to Rheums and external Injuries.

Men and Horses, are the only Animals that have Eyes of different Colours; they are sometimes grey, sometimes black, and sometimes blue; and this Diversity depends upon the different Colours that appear in the Iris.—They are easily annoyed by the Extreams of Heat and Cold, so that a temperate Air, and whatever is moderately hot, agrees best with them.

The Eyes are divided into external and internal Parts; the former cover and guard it, and such are the Eye-brows, and Eye-lids: The latter are lodged within the Socket, and are the constituent Parts of the Globe of the Eye.

The EYE-BROWS, by the Romans, called *Supercilia*, are Hairs, ranged in the Form of a Crescent; the Point thereof, that approaches to the Nose, is called the Head; and the other towards the Temples, the Tail of the *Supercilia*.

The Eye-Brows consists of four Parts. 1. A Membrane, which by its Thickness forms a rising Eminence, and by its Hardness, keeps the Hairs fast. 2. Muscular Parts, which serve to raise 'em. 3. The Hairs to prevent Sweat, and other Nuisances, falling down into the Eyes. 4. Fat, which serves for Nourishment to the Hairs.

The Eyes are also covered and defended with the *Palpebræ*, or Eye-lids, whose Motion is so quick, in human Bodies, that nothing is reckoned so short as the Twinkling of an Eye.

The PALPEBRÆ, or Eye-lids, consist of a thin, muscular Membrane, covered without Side, with a strong, yet flexible Skin; and lined within Side with a Production of the *Pericranium*.—Their Edges are fortified with a strong Cartilage, by Means whereof they are enabled to close the better.

Out of these Cartilages, grows a Palisade of stiff Hairs, called *Cilia*; of great Use to warn the Eye of the Approach of Danger, either in sleeping or waking; to keep off Motes, Flies, &c. and break the too fierce Impression of the Rays of the Light.

These Hairs, it is observed, only grow to a certain convenient Length, and never need cutting, as most others do; add to this, that their Points stand out of the way; those of the upper Eye-lid being bent upwards, as those of the lower downwards.

At the Commissure or joining of the upper and under Eye-lids, are formed two Angles called *Cantby*.

(G) In the inner of these, is placed the *Glandula Lachrymalis*, which is furnished with Arteries that spring from the *Carotides*, Veins that unload in the *Jugular*; Nerves derived from the fifth and sixth Pair; and excretory Vessels, which perforate the inner Coat of the Eye-lids, near the *Cilia*.—This Gland filtrates a viscid Serosity, which it throws in between the Body of the Eye, and the *Palpebræ*, in order to facilitate their Motion.

Near the other Angle is a Gland, called *Innominata*, which helping by several Branches to irrigate the Eye, the Overplus is carried to the greater Angle, and transmitted to the Nose, through the *Puncta Lachrymalia*, which are the Orifices of a little membranous Bag, whose Ulceration occasions a *Fistula Lachrymalis*, and hinders the Transfusion of Tears into the Nostrils.

The Eye lids are both moveable; especially the upper, which has two Muscles to raise, and depress it, called *Attollens* and *Deprimens*, or *Orbicularis*.

(H) The *Attollens* springs from the Bottom of the *Orbita*, above the Perforation of the optick Nerve, and is inserted with a broad Tendon in the Edge of the upper *Palpebra*.

(I) The *Deprimens* proceeds from the great, or inner Corner of the Eye, and passing above the upper Eye-lid, marches to its Insertion in the little or outer Corner.—When this Muscle is employed, it draws down the upper Eye-lid, and covers the Eye; and in Order to a more exact Shutting of the Eye, one Part of it passes through the lower Eye-lid, and is inserted in the little Corner; for by the two Parts it shuts the Eye very nicely.

Animals that have hard Eye-lids, as Lobsters, and the Generality of Fishes, have no *Palpebræ*, as being sufficiently secured without.

In the Generality of Brutes, is a Kind of third Eye-lid, which is drawn like a Curtain, to wipe off the Humidity which might incommode the Eyes; it is called the *Nititating Membrane*.

The Monkey is almost the only one that wants it, as being furnished like Man, with Hands to wipe the Eye on Occasion.

At present for the inner Parts of the Eye.—The EYE, properly so called, is of a globular Figure, and consists of Tunics, Humours and Vessels.—In some Parts it is lined with Fat, (as in the Cavity of the Orbita) and is moved with six Muscles, four of which are strait, and two obliques.

(III) The *Streights* come from several Points of the Bottom of the Orbit, and run immediately between the *Sclerotica* and *Adnata*; they derive their several Denominations from their several Offices, viz. *Attollens*, or *Superbus*, which draws the Eye upwards: *Deprimens*, or *Humilis*, which casts it down; *Adducens*, or *Potator*, which draws the Eye towards the Nose: And *Abducens*, or *Indignator*, which draws it the other Way towards the lesser Angle.

(K) The two *Obliques* are the Superior, called *Rotator*, which proceeds from the inner Part of the Orbita, ascends along the Bone to the upper Part of the great Corner, where its Tendon passes through a little annular Cartilage, called *Trochlea*, and afterwards terminates in Company with the *Obliquus Minor*, near the lesser Corner.

(L) The inferior *Oblique* sets out from the lower and outer Part of the Orbita, above the Union of the two Bones of the upper Jaw, and is inserted in the lower Part of the Cornea, near the lesser Angle.—These two Muscles move the Eye obliquely, and wind it round; and such are the usual Motions of Lovers Eyes, when fixed upon the Object they love.

When the Muscles of the Eyes have not acquired an Habit of acting in Concert, (which falls out very often in Children) they render the Person squintey'd.

The Nerves of the Eye are the *optic Pair*, which issuing thro' a Perforation in the Skull, behind the Orbit, enter the Ball of the Eyes, deface and lose themselves therein; besides which the *Motorii Pathetici*, the first Branch of the fifth Pair called *Optthalmicks*, and the sixth Pair are bestowed on the Muscles of the Eye.

The Eyes receive Arteries both from the internal and external *Carotides*, and return the Blood by Veins that go to the Jugular.

The Eye has six Membranes, four of which are Common, viz. the *Conjunctiva*, *Cornea*, *Uvea*, and *Retina*; and two Proper, viz. the *Vitreum*, that contains the vitreous Humour, and the *Arachnoidea*, in which is the Crystalline Humour.

(M) The *CONJUNCTIVA* is smooth, polished, and of an Alabaster white Colour, in a sound State, and is fastened by some Ligaments to the *Pericranium*.—The *Conjunctiva* does not form the whole Ball of the Eye, for it terminates upon the Edge of the *Cornea*.—'Tis strewed with Millions of Arteries and Veins, which never appear but when the Blood is more rapid than usually, as it happens in the Diseases called *Ophthalmicks*.

(N) The *CORNEA* proceeds from that Part of the *Dura Mater*, in which the optic Nerve is wrapped, and passing under the *Conjunctiva* becomes conspicuous in the Gap which that Coat leaves in the Fore-Part of the Eye.—This Membrane being transparent on the Fore-Side, bears the Name of *Cornea* in that Part; but being thick and opaque at the Bottom, where the *Conjunctiva* covers it, that Part of it is therefore called *Sclerotis*, i. e. hard.

(O) The third Coat is the *UVEA*, called also *Choroides*, from its Resemblance to the *Chorion*. It proceeds from the *Pia Mater*, which covers the optic Nerve. Of the Duplicature of this Part, is formed a striped, variegated Circle, called the *Iris*.—In its Middle is an Aperture, called the *Pupil*, or *Apple* of the Eye, about which the *Iris* forms a Ring. From the Inside of this Tunic spring certain Fibres, which spreading round the Crystalline Humour, form the *Ligamentum Ciliare*.

(P) The *RETINA*, so called, from its being drawn up in the Form of a Net behind the Humours,

consists of a Dilatation of the optic Nerve, and receives the Impression of Objects; for of all the Tunics of the Eye, this alone is untransparent; so that the *Species* of Objects, after passing through the other Membranes and Humours, reflect upon the *Retina*, which represents them to the Brain, according as it receives them.

(Q) The *VITREA*, from its glassy Humour is the 5th Coat, and the first of the proper ones; it spreads out through the whole Substance of the Humour, small Filaments, which hinder it from slipping out of its Place; but when the Coat, which is very thin, is broken, the Humour melts, and turns all into Water.

(R) The Second of the proper Coat is entitled *Arachnoidea*, from its being thin, like a Cobweb. This Tunic serves for an immediate Cover to the Crystalline Humour, and is transparent, that the Images of Objects might appear in it as in a Looking Glass.

The *Humours of the Eye*, enclosed within these Tunics, are three, viz. 1. the *Aqueous*, a limpid, transparent Humour, situate in the Fore-part of the Eye immediately under the *Cornea*, and occasioning its Protuberance.

(S) 2. The *CRYSTALLINE* is situated immediately under the Aqueous, behind the *Uvea*, opposite to the *Pupil*.

(T) 3. The *vitreous*, or glassy Humour, which fills all the Part of the Cavity of the Globe; and is that which gives the spherical Figure to the Eye.

The whole Structure and *Apparatus* of the Eye tends to this, that there be produced a distinct and vivid Collection in the Bottom of the Eye, directly under the *Pupil*, of all the Rays, which proceeding from any Point of an Object, and entering the Eye, penetrate the crystalline Humour; and that so many Points being painted in the Bottom of the Eye, as are conspicuous in an Object, that so a small Image like thereto, may be represented in the *Retina*.

In Order to this the Rays from any radiant or reflecting Point, striking on the *Cornea*, are refracted towards the Perpendicular, and thus determined to proceed through the Aperture of the *Pupil* to the Surface of the Crystalline, while other Rays, which entered so obliquely as to be thrown upon the *Iris*, are reflected out again, that they may not disturb the Distinctness of the Sight; and others, whose less Obliquity threw them between the *Uvea* and vitreous Humour, are extinguished in the Darkness thereof; that none can be propagated through the *Vitreous*, but such as passing through the *Pupil*, strike on the *Crystalline*.

In the mean Time the *Iris* contracting by its Circular, or dilating by its right Fibres, the *Pupilla* of the Eye, admits fewer or more Rays, as the Object is nearer, or more vivid; or remoter and more languid.

Now the flatter the Figure of the *Cornea* is, the less does it collect the Rays emitted from any lucid Point; whence fewer arrive at the *Crystalline*, and those more diverging, unless when they come from a very remote Object: On the contrary, the rounder it is, the more of the Rays from any Point does it collect and throw on the *Crystalline*, and those the more converging; whence one great Cause of the Defects of the Eyes both of old Men and Myopes. Again, the Rays transmitted through the *Pupil* to the *Crystalline*, are there refracted a-new, further collected, and rendered converging; so as that those which came from the same Point of Object, are now thrown in one Point through the *Vitreous*, upon the *Retina*, where they paint or exhibit that precise Point of the Object whence they flowed. Accordingly if the *Crystalline* be very dense, or spherical, the *Focus*, or the Point wherein they are united will be too near; and if too flat or rare, the Point will be too remote: The Effect of both which, is Confusion.—And hence another Cause of the Defects of *Myopes* and *Presbites*.

As complex as the Mechanism of the Eye may seem, and as manifold as the Parts are which have Relation thereto, the Justness of Vision seems to require

quire an exact Habitude in them all.—Thus, tho' the *Pupil* be no substantial Part of the *Eye*, but only an Aperture of the *Uvea*, almost perpetually changing its Bigness, according to the different Degrees of Light, the *Eye* chanceth to be exposed to; and therefore should seem, while this Hole remains open, to perform its Office, by giving Entrance to the incident Rays of Light; yet Mr. Boyle saw a Woman, who, after a Fever, not being able to dilate the *Pupilla* of her Eyes, as before, though they were little narrower than ordinary; yet had she thereby almost lost her Sight.—And on the other Side, though a competent Wideness of the *Pupil* be requisite to a clear and distinct Vision, yet if its Dilatation exceeds the due Limits, there is thereby produced a considerable Distemper of Sight. It may seem also but a slight Circumstance, that the transparent Coats of the *Eye* should be void of Colour; and of as little Moment, that the *Cornea* should be very smooth, provided it remain transparent; yet, when either of these Circumstances is wanting, the Sight is greatly vitiated.—Thus we see that in the Yellow Jaundice, the adventitious Colour wherewith the *Eye* is tinged, makes the Patient think he sees many Objects yellow, which are of a contrary Colour.

It has of late been an Opinion, that though both Eyes be open, and turned towards an Object, yet only one of them at a Time is effectually employed in giving the Representation; so that the having of two Eyes should seem in some Sort a Redundance.—But Mr. Boyle furnishes several Considerations which invalidate this Opinion, and shew, that both the *Eyes* are of Use at the same Time.—He assures us he has found by frequent Experiment, that his two *Eyes* together beheld an Object in another Situation, than either of them a-part would do.—He adds, that he has met with a noble Person, who, in a Fight had one of his Eyes strangely mangled by a Musket-Ball, which came out at his Mouth; after which Accident, he could not well pour Drink out of one Vessel into another, but had broken many Glasses, by letting them fall out of his Hand, when he thought he had given them to another, or set them down on the Table: He added, that this Aptness to misjudge of Distances and Situation continued with him, though not in the same Degree, for two Years.

The noblest and most excellent Sense next to Seeing is that of *Hearing*; therefore I will examine here the admirable Structure of the Parts employed therein.

The *EAR* is the Organ of *Hearing*, or that Part whereby Animals receive the Impression of Sounds.

The *Ear* is divided into the outer and inner Part. The Former is that which appears upon the external Surface; the Latter consists of several Particles and Cavities within the *Os Petrosa*.

(X) The outer Part, or *Auricle*, is Semicircular, and contains divers Sinuosities.—Its upper Part, which is the broadest, is called *Ala*, or Wing, and the Latter, which is narrow, soft, and pendulous, the *Lobe*, or *Fibra*, being that to which Ladies hang their Ear-rings, &c.

The outer *Area*, or Extent of the *Auricle*, is called the *Helix*, and the inner, opposite thereto, the *Antihelix*; the little Protuberance of the Side next the Face, is called the *Tragus*, or *Tircus*; and the Ridge just above, and opposite to it, an *Antitragus*: And the Cavity, leading to the Beginning of the *Meatus*, the *Concha*.

The *Auricula*, or the outer Part of the *Ear*, consists of a thin Cartilage covered with a Skin, Ligament, Nerves, Arteries, Veins, and Muscles.—The Cartilage is not divided in Men, as it is in other Animals.—The Ligament fastening the *Ear* to the *Os Petrosus* is strong, and proceeds from the *Pericranium*.—The Nerves spring from the second *Vertebra* of the Neck; the Arteries from the *Carotides*; and the Veins repair to the *Jugulares*.

Though the *Auricula* has no manifest Motion, yet

'tis provided with four Muscles; one Superior and three Posteriors.

(Y) The *Superior* proceeds from the *Musculus Frontalis*, it being Part thereof, and is inserted in the *Auricle*, which it pulls upwards. The other three; which make but one fleshy Body, rise from the *Os Occipitis*, and the mamillary Processes, and is inserted behind at the Root of the *Ear*.—It serves to pull the *Ear* backwards and downwards. (ZZZ)

The external *Ear* is not the principal Organ of Hearing, though, at the same Time, it contributes very much to the Perfection of that Sense, in receiving the Sounds, and introducing them to the *Meatus* of the internal *Ear*; since those, whose *Ears* are cropt or cut off, have but a confused Way of Hearing, and are obliged either to form a Cavity round the *Ear* with their own Hands, or else to make use of a Horn, and apply the End of it to the inner Cavity of the *Ear*, in Order to receive the agitated Air.

Under the *Ears* we meet with big conglomerated Glands, for the Secretion of the *Saliva*, called *Parotides*.

The inner Part of the external *Ear* is possessed by the *Meatus Auditorius*, or Auditory Passage, which commences from the Bottom of the *Concha*, called the *Alvearium*, and is continued in a winding Direction, turning sometimes this Way, and sometimes that, to the *Membrana Tympani*.—The *Meatus* is dug out of the *Os Temporis*, and lined with a Membrane, furnished with divers little Glands that separate a thick, yellow, glutinous Humour, called *Cerumen*, or Ear-wax, serving to defend the *Ear* from the Ingress of Vermin, and other extraneous Bodies.—The external *Ear* is separated from the internal by a thin, dry, round, and transparent Membrane, called, improperly *Tympanum*, or *Drum*, and placed at the further End of the *Meatus*.

Behind this Membrane is a Cavity, called the Barrel of the *Drum*, being three or four Lines deep, and five or six broad.—In this Cavity are three little Bones, viz. the *Malleus*, *Incus*, and *Stapes*; i. e. the Hammer, the Anvil, and the Stirrop, which we have seen in the *Osteology*.—Their Articulation is such, that the *Malleus* is fastened to the *Tympanum*, which communicates to them that which it receives from the Air.

To give Motion to these Bones is the Office of a Muscle placed in the Barrel of the *Drum*, which produces a Tendon, which fastens it to the Process, which the Handle of the Hammer obliges to approach to its Head.—The Action of this consists in pulling the Handle of the Hammer inwards, and in stretching the Membrane of the *Drum*, which afterwards unbends when the Muscle ceases to pull; for the little Bones are so articulated, and mutually joined by Ligaments, that they make a Sort of elastick Spring, which, in Conjunction with that of the *Drum*, serves for an Antagonist to the Muscle.

Two *Meatus* are situate at the Side of the Cavity, one opening into the Palate, called *Aqueduct*, which is partly cartilaginous, and partly membranous, and the other shorter and bigger, opening into the *Sinus* in the mamillary Process.

We come next to two Gaps, or Apertures, called *Fenestra Tympani*, which are placed in the Surface of the *Os Petrosus*, which is opposite to the Membrane of the *Tympanum*. The first, called *Fenestra Ovalis*, by Reason of its Figure, is situate a little higher than the other, and receives the *Basis* of the *Stapes*; the other *Rotunda*, notwithstanding its Figure, is oval like the former, and closed by a thin, dry, transparent Membrane, resembling that of the *Tympanum*.

Anatomists are not agreed upon the Use of a small Chord, which lies in the Cavity of the *Tympanum*, and runs over the inner Surface of the Membrane, called *Chorda Tympani*; some will have it an Artery, some a Nerve, others a Vein, or the Tendon of the Muscle of the *Malleolus*; but it is now discovered to be

be a Branch of the fifth Pair of Nerves, which meets the *Portio Dura*, the hard Part of the auditory Nerve.

The two *Windows*, or *Fenestræ*, above-mentioned, open into a Cavity, dug out of the *Os Petrosum*, which for its *Detours* and Meanders is called the *Labyrinth*.

The Pipes whereof the *Labyrinth* consists, are called by different Names.—The Beginning of the Cavity is called *Vestibulum*, by Reason it leads into the other two; in it are observed nine Apertures, or *Foramina*.—From the *Vestible* there set out three semi-circular *Meatus's*, which return to it by another Road.—All these surround the *Forinx* of the Vestible, and one of them has the Name of *Orizental*, while the other two are called *Vertical*.—In the *Labyrinth* is supposed to be contained the innate Air.

The *COCHLEA*, Snail or Shell, is the last Cavity which consists of two Parts, *viz.* a spiral, semi-oval Canal; and a *Lamina* formed into a spiral Flight. The Canal makes two Turns and a Half round a Newel, or Axis, still growing less as it ascends.—The spiral *Lamina* divides this Cavity into two, being fastened by its Base to this Axis, and by its other Extremity, to the Surface of the Canal, opposite to the Axis, by Means of a very fine Membrane.—The Cavity of the *Cochlea* thus divided, forms, as it were, two Stair-cases, both formed on the same Newel, one over the other, but without any Communication between them.

The *Aquæduct* is the *Auditory Nerve*, which consists of two Branches or Parts; the one soft, called *Portio Mollis*; and the other harder, *Portio Dura*: The first Part is spent on the Organ of Hearing, being divided into five Branches, which form a delicate Web, that lines the *Vestibulum*, *Cochlea*, &c.—The hard Part passing out of the *Cranium*, is distributed among the Parts of the external Ear.

The Sense of Hearing is performed in the following Manner.

The external Air being tossed by very quick and nimble Concussions, enters the first *Meatus*, and strikes upon the Drum; and that Membrane being thus connected, shakes the small String behind it, and the three little Bones that are knit to it; and by that Means conveys the external Motion to the internal Air: Upon which this Air subtilizes itself, and fortifies its Agitation in the Windings of the *Labyrinth*, and by entering into the spiral *Cochlea*, as advancing from a broader to a narrower Space; the Air thus subtilized, communicates itself to the Nerve, which conveys it to the common *Sensorium*. So that these different Modifications of the Air, move the Imagination, to form the Sensation, called *Sound*; for Hearing is no Action, but only the Reception of the Impression of the Air, into the Nerves that visit the Ear.

Distempers incident to the *Ear*, and adjacent Parts, are *Noises*, *Otalgia*, *Otocel*, *Deafness*, &c. of which more at large in our Treatise of the Maladies incident to the human Body, under the Letter *M*.

Several Naturalists and Physicians have held, that cutting off the *Ears* renders Persons barren and unprolific, which Notion was what first occasioned Legislators to order the *Ears* of Thieves, &c. to be cut off, lest they should produce their like.

The Dauphiness, Grandmother to the present King of France, Lewis XV, had brought into a Custom in France, the cutting off of *Ears*, as a Punishment for Deserters, which having been sound since, too cruel and barbarous, has been changed into that of splitting only the *Lobe*.

The *Ear* has its Beauties, which a good Painter ought by no Means to disregard: Where it is well formed, it would be an Injury to the Head to be hidden.—*Suetonius* insists particularly on the Beauties of *Augustus's Ears*; and *Ælian*, describing the Beauties of *Aspasia*, observes, she had short *Ears*.—*Marital* ranks large *Ears* among the Number of Deformities.

Among the *Albenians*, it was a Mark of Nobility and Distinction, to have the *Ears* bored and perforated, as it is still in some Parts of *Asia* and *Africa*.—Among the *Hebrews* and *Romans*, it was a Mark of Servitude.

The next Sense which offers itself to our Consideration, is that of Smelling, and the *Nose* is the Organ thereof.

The *Nose* is divided into the Root or upper Part, which lies between the two *Eyes*; the lower or *Dorsum*; the *Spina* or pointed Part, which is yet lower; the cartilaginous moveable Tip; the little Globe; the lateral Parts; the *Alæ* or Wings; and the *Columna* or Pillar, which is the fleshy Part that advances in the Middle, and separates the two Nostrils.—These are called external Parts.

The Teguments of the *Nose* are common to the rest of the Face; under these appear the Muscles of the *Nose*, which are seven in Number, *viz.* one common, and six proper.—Of the last Sort, four dilate it, and the other two contract it.

The common Muscle is a Part of the orbicular Muscle of the Lips; it draws the *Nose* downwards, when it brings the upper Lip to approach the lower.

3. The *Pyramidales* or *Triangulares*, which are the two first of the proper Class proceed from the Suture of the Forehead, and are inserted with a broad Tendon in the *Alæ* of the *Nose*, which they serve to draw asunder.

4. The *Dilatantes*, so called from their serving to widen the external Apertures of the Nostrils, and resemble a Myrtle-leaf, proceed from the Bone of the *Nose*, near the *Alæ*, and terminate in the round place of the same Wing.

5. The *Constringents*, which draw the Wings of the *Nose* downwards, and at the same Time the upper Lip also downwards, have an inner Situation, being hidden under the Coat that invests the Nostrils. They spring from the inner Part of the Bone of the *Nose*, and are inserted in the internal *Alæ* of the *Nostrils*.

The upper Part of the *Nose* being bony, there are five *Cartilages* under these Muscles, which form the lower Part; the two superior *Cartilages*, which are broad upwards, but soften and grow narrow in their Descent, adhere to two Bones of the *Nose*: The other two, which form the *Alæ*, are fastened to the Extremities of the superior ones, by membranous Ligaments; and the fifth is placed in the Middle for a Partition between the two Nostrils.

The Membrane of the *Nose* is furnished with large Arteries from the *Carotides*; and Veins which empty themselves into the Jugular; and Nerves from the fifth Pair, as well as the olfactory Nerve.

In this Membrane is a great Number of small Glands, which filtrate a white viscous Liquor, called *Snot*.—Besides these two Sinks, there are some others that convey a Liquor like the former into the Nostrils.

By Means of this *Mucus* or *Pituita*, is the Membrane kept soft, and defended from the Injuries of extraneous Bodies, especially those of the Air; which must pass this Way in Inspiration, when the Mouth is shut.

The first of the excretory Ducts is the *Canalis Nasalis*, formed by the Coition of the two lachrymal Points, that pass through the *Foramen* of the *Os Unguis*.—Through this Passage, Part of the Humour that waters the Eye, distils into the *Nose*.—The second, is the two Holes of the *Sinus Frontales*, which unload in the *Nose*, a Snot filtrated by the Glands of their Membrane.—The third is the two Holes of the *Sinus's* of the *Os Sphenoides*, there being one on each Side.—The fourth is the two Orifices of the maxillary Cavities.—The fifth is the *Aquæduct*, some Part whereof is invested with the glandulous Membrane of the Nostrils.

The *NOSTRILS* are the two Apertures at the Basis of the *Nose*, or the Commencement of two Cavities, which

which afford a continual Ingress and Egress to the Air.—Each of these Cavities divides afterwards into two others, one of which ascends towards the Sieve-like Bone, and the other descends to the Palate, in order to empty itself in the Bottom of the Mouth, and the Throat.

There are two other Conduits, which run from the *Nostrils* to the Mouth. They commence at the Bottom of each *Nostril*, and passing over the Palate, perforate it under the fore Teeth, where they come to a Period.

The whole inner Capacity of the *Nose* is lined with a pretty thick Coat, which is a Continuation of the *Dura Mater*, at the lower Part whereof grows some Hairs, visible at the Entry of the *Nose*, and of very little, or no Use.

The internal *Nose* is filled with several cartilaginous Plates separated from one another, whose Extremities terminate at the Root of the *Nose*, and which serve to support its inner Coat, which having a very long Extent, is therefore folded into the little Cavities of the *Nose*, runs quite round these *Laminae*, in Order to employ all its Length in a narrow Space, and covers their Surface exactly.

In this inner Tunicle of the *Nose*, the Olfactory Nerves are diffused, and rendered capable of the Perception of *odoriferous Effluvia*, which is effected in the following Manner.

The little Atoms that exhale from odoriferous Bodies, are carried along with the Air to the *Nose*, where, by striking upon its inner Membrane, they jog the small Pipes of the Olfactory Nerves, immediately the subtle Matter with which they are filled, partakes of this Commotion, which by Virtue of the Continuity, flies in a Moment to the *Corpora Striata*, from whence these Nerves proceed, and whereof our Imagination, sensible of the different Undulations, which each Object can occasion in the Spirits, perceives that this is the Impression of an odoriferous Body; whence proceeds the Sensation, called *Smelling*, which is not an Action, but a passive Quality of the Olfactory Nerve.

Besides this Use of the *Nose*, which is the Principal, Nature has made it, as it were, a *Diverticulum* to the *Eyes*, there being a considerable Passage into each *Nostril*, that empties itself under the Middle of *Os turbinatum*, arising from two Apertures, called *Puncta Lacrymalia*, at the great *Cantus*.

By this Way the superfluous Moisture of the *Eyes* is carried off, which would otherwise incommode the Cheeks, as in Effect it does, when those Parts are affected with any Disorder; as in the *Ægilops*, and *Fistula Lacrymalis*.

The Diseases of the *Nose*, are a *Coryza*, *Ozaena*, *Polypus*, *Sarcana*, *Noli me Tangere*, *Sneezing*, and the *Loss of Smelling*.

The Figure and Magnitude of the *Nose* cannot be nicely adjusted, because some have bigger *Noses* than others. A great hawk *Nose* is preferable to a flat one; for besides that, a large *Nose* never spoils the Face, open and wide *Nostrils* are still better than little narrow ones, upon the Account of the Convenience of Respiration, as well as Beauty.

In *Tartary*, the greatest Beauties are those which have the least *Noses*; the Wife of *Zinghischan*, Mother of *Tamerlane*, is mentioned by *Ruybrock*, as a celebrated Beauty, because she had only two Holes for a *Nose*.—Those Sorts of Beauties are not often toasted under our Hemisphere; for though our Wives have often their *Nose*, in their Way, and we are often led by the *Nose*, by them; we nevertheless prefer all those Inconveniencies to that of having no *Nose* at all.—Therefore we are very far from following the Custom of the *Crim-Tartars*, who break the *Noses* of their Children in their Infancy, for Fear it should stand before their *Eyes*; for when they have their *Nose* broken, they must have done it themselves; and very much against our Inclination.—We must reasonably suppose, that in those Countries they have not the least Notion of the Use of *Spectacles*, or that

the Extirpation of the *Nose* strengthens their Sight, in strengthening the *Optick*, by the Obstruction of the *Olfactory Nerve*.—It is true, that among us, the Loss of one's *Nose* is a Mark of Distinction, and of the Courage and Bravery of those who have fought under *Cupid's* Standard, but that Badge is not much ambitioned, not even by the greatest of our Heroes.

The *Italian* *Nose-mender*, mentioned by *Amb. Paré*, would be of some Service to our *Gladiators* on *Venus's* Amphitheatre, who in their warm Encounters have sometimes the Misfortune to lose their *Nose*.—His Method (says our Author) was to make an Apperture in the Patient's Arm, and there to engraft the mutilated *Nose*; the Arm being bound up for four and twenty Days, the *Nose* took Root in the Wound, and glewed itself with the Flesh of the Arm, and grew to its Bulk; which done, he cut off the Flesh of the Arm, and fashioned the *Nose* to its liking, applied it in its Place, and healed the Wound at his Leisure.—In all Appearance, the Vessels of this new *Nose*, had also a very great Analogy with those of the Parts it was applied to; and the Artist was so dextrous in the Application, as to have their *Tubercles*, meet exactly for the Circulation of the Juices, and the Nourishment of the additional Part.—Which seems to me somewhat difficult in the Execution; for really I cannot say of this, that *Si non e vero, e bene trovato*.

Before we examine the *Tongue*, which is the Organ of Taste, it will not be improper to premise an Account of the *Mouth* which contains it.

The MOUTH has two Lips, one above, and another below, which are a fungous Flesh, covered with a very thin Coat, continuous with that of the Mouth.

The LIPS have several Glands placed under the Coat that covers them, and which are furnished with little Arteries from the *Carotides*, and Veins which carry back the Blood to the external Jugulars.

The Lips have thirteen Muscles, eight proper, and five common. Of the proper, four belong to the upper, and four to the lower Lips; of the common, two are allotted to each Lip, and an odd one.

(7) The first of the Proper, which belong to the upper Lips, proceeding from the upper Jaw-bone, where the Fore-teeth *Incisores* are placed, is called *Incisvius*, and inserted in the upper Lip, which it pulls upwards.

(8) The second, its Antagonist, is called *Triangularis*, springs from the lateral and external Part of the *Basis* of the lower Jaw-Bone, and is inserted near the Corner of the Mouth in the upper Lip, which it pulls downwards.

(9) The third, called *Montanus*, allotted to the lower Lip, proceeds from the fore and lower Part of the Chin, and from the Root of the Fore-teeth of the lower Jaw; and terminates in the Brim of the lower Lip, which it draws down.

(9) The fourth is the Antagonist of the last, and is called *Caninus*, from its proceeding from the upper Jaw-Bone above the Eye-teeth. 'Tis inserted in the lower Lip, near the Corner of the Mouth, and serves to draw up this Lip.

(10) The *Zigmaticus*, from its Procession from the *Zygoma*, is the fifth Muscle, and the first of the common Sort. 'Tis inserted in the Corner of the Mouth, to draw it towards the Ears.

(12.) The sixth rises from the Roots of the Grinders of both Jaws, and terminates in the Circumference of the Lips. 'Tis called the *Buccinator*, from its Action in swelling and enlarging the Cheek, when we sound a Trumpet.

(13) The odd Muscle, called *Orbicularis*, is the Flesh that encompasses the two Lips, like a *Sphincter*, and shuts the Mouth, by drawing them together.

The Nerves of the Lips come from the fifth, sixth, and eighth Pair of the Head, and some from the *Par Accessorium*.

When the Mouth is well made, with ruby Lips, it contributes much to a beautiful Face. The Mouth is of a contrary Mould from the Eyes; for a little

Mouth is always handsomest; whereas the largest Eyes are hardly such.

Under the Eyes, between the Nose and Ears, lies a round Prominence called the *Pomum*, stiled the Seat of Shame, because it reddens or grows pale in the Recess of that Passion; the loose Part under it is called the Cheek, or *Bucca*; the upper Part of the upper Lip, *Myrtax*; in the Slit between the two Lips, Mouth; the prominent Parts of the Lips, *Prolabia*; the lower Part of the Under-Lip, Chin; and the fleshy Part under the Chin, *Buccula*.

Within the Mouth are contained the *Gums*, the *Palate*, the *Uvula*, and the *Tongue*.

The *Gums* serve to keep the Teeth fast in their Sockets, and consist of a hard and solid Sort of Flesh, that possesses the upper Part of those Sockets or *Alveoli*.—When the Teeth are corrupted, sometimes small Abscesses happen in the *Gums*, which Surgeons are obliged to open with a Launcet.

The *PALATE*, also called the Roof of the Mouth, from being its upper Part, is formed by the maxillary Bones, and the Bones of the *Palate*, and covered with a thick, shrivelled Membrane.

The Substance of this *Tunicle*, is strewed all over with conglomerate Glands, which are continued to the *Tonsils* or Almonds.—These Glands separate a Sort of Serosity, which they discharge into the Mouth by an Infinity of little Pipes that perforate it as if it were a Sieve.

The *UVULA* is a small pyramidal Prominence, which hangs down from the Palate upon the Root of the *Tongue*—'Tis formed by the Union of two little round Muscles, that spring from the *Septum*, or Partition-wall of the Nose; these Muscles serve to raise it, and when the Action ceases, it falls by its own Weight.—Upon the Sides of the *Uvula*, are two Arches, called *Rimæ Nasales*, which consist of semi circular Fibres, covered with a thin Skin, upon which are dispersed little glandulous Grains. When the semi-circular Arches stretch themselves lengthwise, they become strait, in Order to confine the Air within the Mouth, when we blow or heave up the Cheeks; they likewise stop the Entry of the *Larynx*, and so hinders the Air to spring from the *Aspera Arteria*, when we breath, in performing the same Action.

(15, 15) The Motions of the *Uvula* are very manifest in some Persons, and are performed by four Muscles, two called *Peristaphylini Externi*, and two *Peristaphylini Interni*. The two first proceed from the upper Jaw under the last Grinder; and terminate by a slight Tendon in the *Uvula*.

(16, 16) The *Peristaphylini Interni* rise from the inner Wing of the *Pterigoides* Process, where there stands a little moveable Cartilage that ministers to their Motion. After that they mount along the Wing of the Process, and are inserted in the *Uvula*. These four Muscles serve to advance, and draw back the *Uvula*, when we swallow Victuals.—Often-time the *Uvula* is swelled and inflamed, (which the Vulgar call the Falling of the Roof of the Mouth) and sometimes it runs out to such a Length, that Surgeons are obliged to cut off the Tip of it.

(17, 17) Upon each Side of the *Uvula*, betwixt the *Larynx* and the Muscles of the *Os Hyoides*, there stand the *Tonsille* or *Amigdalæ*, conglomerate Glands, I have mention'd with the *Larynx*. They are furnished with all Sorts of Vessels, and strain out the Serum that moisten the *Tongue*, the *Larynx*, and the *Œsophagus*.

The *TONGUE*, which is the Organ of Taste, and the principal Instrument of Speech and Deglutition, is seated in the Mouth under the Arch of the Palate.

The *Tongue* is fastened to the *Os Hyoides*, the *Larynx*, and the *Fauces*, by Means of a membranous Ligament running along the lower Side of it, about half-way, called the *Frenum*.

Its Size is indifferent bulky, and proportioned to that of the Mouth; when too short we cannot shoot it out; when too thick it makes us stammer; and when too soggy and moist, as in Children, they

can't well articulate their Words.

The main Bulk and Body of the *Tongue* is made up of Muscles, which are covered on the upper Part with a papillary nervous Substance, over which is spread a pretty strong Membrane, instead of the *Epidermis*, and full of *Papillæ* of a pyramidal Figure, especially towards the Tip; which *Papillæ* stand pointing towards the Root of the *Tongue* in a bending Posture, which make their Figure to be *Concavo-Convex*.—These *Apices* or *Papillæ* are so very minute and slender in Men, that they make the Coat appear on the upper Part to be villous, especially as they approach towards the Root. The Figure of the *Papillæ* in human *Tongues*, is not so plainly discernable to the naked Eye, as not to need the *Microscope*.

Under this lies a soft reticular Sort of Coat, full of Holes like a Sieve, and always lined with a thick yellowish *Mucus*. This Membrane is so exceeding tender, that it is not to be examined with the naked Eye unless boiled.—After boiling, it appears like a Kind of Gauze, between whose Threads innumerable Holes appear, through which the *Apices* of the papillary Bodies underneath are exerted.—This Membrane on the upper Side next the outward, appears white with a Cast towards yellow, but black on the Side next the *Tongue*.

The greatest Part of the Body of the *Tongue* is musculous, consisting of Plans of Fibres in different Directions: The first or external Plan, consists of strait Fibres, which cover the *Tongue* from one Extreme to the other; when these contract they shorten it. Under this are several other Plans running from the under to the upper Side, which serve to make it broad and thin. These two Kinds of Fibres lie *stratum super stratum*, a Plate of the one, and then a Plate of the other.—'Tis by the Means of these Fibres that the *Tongue* moves itself, and turns like an Eel in the Mouth.

Though the *Tongue* consists of a fibrous and musculous Substance, and by that Means is qualify'd to turn itself any way in the Mouth, yet it is furnished with Muscles for the Performance of its great Motions.—These Muscles are eight in Number, four on each Side.

(23, 23) The first Pair is the *Genioglossi*, which proceed from the lower Part of the Chin, and are inserted in the anterior and interior Part of the *Tongue*; which Muscles pull the *Tongue* forwards, and put it out of the Mouth.

(24, 24) The second is the *Styloglossi*, which spring from the *Styloides* Process, and terminate in the lateral and upper Part of the *Tongue* in order to pull it upwards.

(25, 25) The *Basoglossi*, which move the *Tongue* towards the Bottom of the Mouth, are the third, proceed from the upper Part of the *Basis* of the *Os Hyoides*, and are inserted in the Root of the *Tongue*.

(26, 26) The fourth Pair is the *Ceratoglossi*, which rise from the upper Part of the *Cornu* of the *Os Hyoides*, and are inserted in the Sides of the *Tongue*, which they pull aside and backwards.—When these four Muscles on each Side act successively, they move the *Tongue* round.

Mr. Cooper allows no more than three genuine Pair of Muscles to the *Tongue*, viz. the *Genioglossum*, *Ceratoglossum*, and *Styloglossum*.

Down the Middle of the *Tongue*, lengthwise, runs a Seam, called *Linea Mediana*, which divides it to the Bottom into two equal Parts, but not so effectually, but that the Blood Vessels of one Side communicate with those of the other.—These Vessels are Arteries from the *Carotides*, and Veins called *Ranule*, and are very conspicuous about the *Frenum* under the *Tongue*, serving to re-convey the Blood to the external Jugulars.—These Veins are frequently opened in the *Angina*, and are the last Resort of old Women in this Case.—The Nerves of the *Tongue* come from the fifth, sixth, and ninth Pair, the two first of which have been called *Gustatorii*, and the latter *Motorii Lingue*.

The

The *Tongue* serves for four Uses, 1. To assist the chewing Faculty by turning the Morfels in the Mouth. 2. To promote Deglutition. 3. To join with the Lips in articulating the Voice; for it is by their joint Motion that the Air springing from the Lungs is form'd into Words. 4. To be the principal Organ of Taste.

The TASTE consists in the Fluttering of the Spirits of the *Tongue*, caused by the Salts of the Aliment, which strike upon the Nerves in which they are contained, which Salts grating against the papillary Prominences, occasion Undulations with them, which in the same Moment are imparted to the Spirit contained in the Nerves, and by them transmitted to the *Corpora Striata*, with which they are continuous, and which represent to the Imagination such Impressions as they receive.

We'll conclude our SPLANCHNOLOGY with a Demonstration of the salivary Vessels: Which are four in Number, two of which being superior proceed from the *Parotides*, and the other two which are inferior rise out of the maxillary Glands.

(29) The *Parotides* are large conglomerate Glands placed behind the Ears, and which fill all the Space, between the hinder Corner of the lower Jaw, and the *Mastoides* Process.—They receive Arteries from the *Parotides*, which reach within their Substance; and their Veins run to the Jugulars. The *Saliva* is secreted from the Blood which passes through their Substance; which *Saliva* is received by two Vessels, called *Salivares*, and formed out of several little Branches, which unite upon their Departure from the Glands, and marching along the Cheeks, make a Breach thro' the Middle of them, in order to terminate in the Mouth.

3. The MAXILLARY GLANDS (also of a conglomerate Nature) are placed under the lower *Maxilla*, between the *Larynx* and the *Os Hyoides*. The Arteries, Veins, and *Ductus Salivares*, they are furnished with, are formed by the joint Union of several Branches under the *Digastrick* Muscle.—The *Saliva*, filtrated thro' these Glands, is taken up by those salivary Ducts which unload it in the Mouth, under the Tip of the *Tongue* upon the two Sides of the *Frenum*, by the lower Fore-teeth.—This *Saliva* acts the Part of the first Dissolver of the Aliment.

Here ends my historical Account, or Demonstrations of all the Parts of the Trunk of the human Body, which must be followed in course, by as plain a Demonstration of all the Parts of the Limbs, which are four in Number.—Two superior, called the *Arms*; and two inferior, called the *Legs*; but as those Parts (the Bones excepted, which I have demonstrated in my *Osteology*) are almost entirely muscular, I'll entertain my Readers with a general History of the Muscles, and their Motions, called *Myology*.

MYOLOGY, from the Greek *μῦς*, *μῦς*, a Muscle, and *λογία*, *Discourse*, is a Description of the Muscles; or the Knowledge of what relates to the Muscles of the human Body.

The MUSCLE is a Bundle of thin parallel Plates; and is divided into a great Number of *Fasciculi*, or little *Muscles*, each inclosed in its proper Membrane, from the internal Surface whereof, pass an infinite Number of transverse Filaments, which intersect the Muscles into several distinct *Areas*, filled with their respective *Fasciculi* of Fibres.

A Muscle is usually divided into three Parts, the *Head*, the *Tail*, and the *Belly*.—The *Head* and *Tail*, which are also called *Tendons*, are the two Extremes of the Muscle; whereof the first is fixed to the stable Part; and the latter to the Part intended to be moved.

The *Venter*, or *Belly*, is the Body of the Muscle, being a thick fleshy Part into which are inserted Arteries and Nerves; and out of which issue Veins and Lymphatick Ducts.

All these Parts of a Muscle, the *Belly* and the *Tendons* are composed of the same Fibres; their on-

ly Difference consists in this, that the Fibres of the *Tendons* are more closely and firmly bound together than those of the *Belly*, which are more loose. Hence in the *Belly* there is Room for a sufficient Quantity of Blood to give them an Appearance of Redness; and the Whiteness of the *Tendons* only proceeds from the Blood being in some measure excluded from the Tightness of their Contexture.—The Difference then between the *Belly* and the *Tendons*, seems to be the same, as between a Skein of Thread, and a Cord made of the same Thread.

As the *Muscles* act by having their *Belly* inflated or swell'd; for by that means they are shortened so as to draw or press the solid Bodies to which they are fastened, according to the Direction of their Fibres.—All the Difficulty then, in muscular Motion, is, to assign their Fabrick and the Cause of their Swelling.

Every single Muscle consists of one fleshy Body; and two *Tendons*; but may be again divided into others similar, tho' less; and those again into others still less, yet still similar to the great ones; which Division may be carry'd on to a Degree of Subtlety, that exceeds all Imagination, though it is reasonable to think it must have an End.—The last therefore being similar to the first, must, in like manner, have its *Belly* and *Tendons*; and this is what we commonly call a muscular Fibre, in an Assembly or Union of several whereof a Muscle properly consists.

Dr. Boerhaave, from a Consideration, that the Nerves enter every Muscle along with its Veins and Arteries, and that there laying aside their outer Integument, they are so distributed thro' the whole Body of the Muscle, as that no one Point can be assigned wherein a Part of them is not found; that those Nerves terminated here, and that in other Parts of the Body, the Extremities of the Nerves are expanded, as it were, into Membranes; concludes that the muscular Fibres are nothing else but extremely slender Expansions of the Nerves stript of their Integuments, hollow within, and of the Figure of a Muscle, and full of a Spirit communicated by the Nerve from its Origin in the *Cerebellum*, by the continual Action of the Heart.

Of these Fibres united are form'd *Fasciculi*, or Bundles; which again have their several Membranes wherein they are involved, and kept distinct from others. This Membrane is extremely slender and porous within, full of Oil, which is accumulated in time of Rest, and spent in Motion, furnished by the Arteries; and this Oil, in Conjunction, with a smooth mucous Juice, secreted by small mucilaginous Glands, interspersed among these *Fasciculi*, serves to lubricate the Parts, and preserve the *Fasciculi*, from fretting on each other.

Now, besides the Nerves, there are Arteries also carry'd into the Muscles, and those in such Abundance, and of such Contexture, that one might be inclined to think the whole Body of the Muscle composed of them.

A Muscle has two Sorts of Motion, viz. Contraction and Extension; in the first it shortens, and lengthens itself in the second; and this is the Source of all the different Motions of the Body.

The Motions are either simple or compound. Those which tend directly upwards, downwards, forwards, backwards, to the right, or the left, are called simple; because they are performed by one Sort of Muscle; but when several Muscles act jointly and successively, as when one moves the Arm quite round, it is then a compound Motion.

All Anatomists agree that the Muscles serve to move all the Parts of the Body, when we please, but they do not all equally conceive in what Manner the Muscles act; though it is generally believed that the Cause of their Motion proceeds from the Brain; that as soon as the Will is determined to bow the Wrist, for Example, the Muscles immediately obey, and the Wrist is actually bowed; and that after this Manner.

The

The Blood which is thrown by the Artery into the Body of the Muscle without Interruption, is always ready to rarify itself in order to swell the *Muscle*, but that it cannot compass of itself; for it is by a Mixture of the animal Juice imported to the Muscle by the *Nerve*, that this Rarification is brought about; which by enlarging the Distance between the Fibres, shortens them, and thereupon ensues the Motion of that Part, which is tied to the Tail of the *Muscle*.

This Influx of the animal Juice into the Muscle never takes Place but when we please; and it is that which renders their Motion voluntary; but after all we must not think that the animal Juice is conveyed from the Brain to the Muscles, at the same Time, that the Soul wills the Motion; for the Motion follows so close upon the Resolution of the Will, that the Juice cannot go so far in that Time. But the Case lies here; the Nerves are so many Conduits full of animal Juice, and when the Soul resolves to move any *Muscle*, the Fibres of the Brain press gently upon the Extremity of the Nerves; this Compression forwards the Animal Juice, with which the Nerve is filled, and obliges it to march through the Muscles, where mixing with the Blood, never wanting in such Places, it makes an Ebullition, which is followed by an Intumescence or Swelling.

Dr. *Boerhaave* finding all that's requisite in the nervous Juice, for the Motion of the *Muscles*, thinks it needless to have Recourse to a Mixture of several Liquors where one will do; and therefore makes no Scruple to attribute the whole Business to it alone.—The Manner of Action he conceives thus:

Suppose the Spirit from any Cause to be moved more swiftly from the Origin of some one Nerve than through the Rest; the *Influx* will be here greater, into the muscular Fibre open to this Nerve than into another: This will therefore be more dilated; and the other *Phænomena*, mentioned above, will succeed. The same Cause continuing, the Effect will be increased, so that in a Moment the whole will be swelled up; and while the same Determination lasts, will remain contracted: And this obtaining in an infinite Number of *Fibrille* at once, the whole *Muscle* will be inflated.

Hence it necessarily follows, that as the Celerity is

increased in one Nerve, the Motion will be less in another; this therefore being relaxed, the Effort in Contraction will be the stronger, for which Reason all the turgid Fibres of a *Muscle* will compress the intermediate Place, and Blood, with a great Force, whence the Veins will be emptied, and the Arteries being compressed will repel the grosser, that is the red Parts of the Blood, but will drive the more subtile Parts, by the Force of the Heat and their own into the most minute Canals; and thus the *Cruor* being expelled, the whole Body of the Muscle will be found to act by a subtile Humour, concurring from the Nerves and Arteries.

Thus are all the *Phænomena* accounted for, without any other Assumption than an accelerating Force in the Origin of the Nerves; which is common to all Hypotheses, and cannot be traced any further.

Dr. *Lower* and Mr. *Cowper*, and after them Dr. *Morgan* and others of the latest Authors on that Subject, setting aside all adventitious Fluids, account for muscular Motion, from the intrinsic Elasticity of the nervous *Fibrille*, contracting and restoring themselves against the stretching Force of the circulating Blood.

All the *Muscles* employed in the same Motion are called *Congeneres*; and those which perform opposite Motions *Antagonistæ*.

As for the Number of the *Muscles* it is hard to determine it, for some *Anatomists* have enlarged it so far as to reckon 529.

From this Demonstration of the *Muscles* in general we'll descend into a more particular Description of them.—I'll begin by the Muscles of the lower Jaw, the *Os Hyoides*, the Head, and the Neck.

But to proceed with some Order in this *Myology*; and to ease the Reader's Memory, we'll reduce the Description of the Muscles, assigned to each Part of the human Body, to the following clear and concise Method or Table, divided into four Columns; The first whereof will point the References to the Print; the second contain the Number of the Muscles of each Part; the Third, whence they proceed; the Fourth, their Insertion; and the Fifth, the Nerves, Arteries, Veins, &c. each of them is furnished with.

Reference.	Number 12.	The Muscles of the Lower- Jaw are	Proceed	Inserted	Nerves and Vessels.
A	1st	<i>Crotaphites</i> ,	from the <i>Coronal</i> , <i>Parietal</i> , and <i>Petrosum</i> ,	with a nervous Tendon in the <i>Corona</i> of the lower Jaw.	Nerves from the 3d and 5th Pair; Arteries from the <i>Carotides</i> ; its Veins are empti- ed in the <i>Jugu- lares</i> .
B	2d	<i>Pterygoides Exterior</i> ,	from the <i>Pterygoides</i> Pro- cess,	in the Interstice betwixt the Head and the <i>Corona</i> of the lower Jaw.	
D	3d	<i>Masseter</i> ,	from the Cheek-Bone and the lower Part of the <i>Zygo- ma</i> ,	in the external Corner of the Jaw, and in its Middle.	
C	4th	<i>Pterygoides Interior</i> ,	from the inner Part of the <i>Pterygoides</i> Process,	in the inner Part of the Cor- ner of the lower Jaw.	
F	5th	<i>Cutaneus</i> ,	from the upper Part of the <i>Sternum</i> , <i>Clavicula</i> , and <i>Acro- meon</i> ,	in the external Part of the <i>Basis</i> of the lower Jaw.	
G	6th	<i>Digastricus</i> ,	from a <i>Fissura</i> or Chink be- tween the <i>Os Occipitis</i> and the <i>Massoides</i> Process,	in the lower and inner Part of the Chin.	

R E M A R K S.

The *Crotaphites* is knit to the Outside of the *Corona*, (its Wounds are oftentimes mortal by Reason of the Convulsions they cause) and the *Pterygoides* exterior to the Inside; the *Masseter* to the Outside Corner of

the Jaw, and the *Pterygoides* interior to the Inside.

These four Muscles concur jointly to the Action of Chewing, by drawing up the lower Jaw to the upper, and joining them very close.

The Office of the *Cutaneus* and *Digastricus* is to open or pull down the lower Jaw, assisted therein by its own Weight.

Refer- ence.	Number 10.	The Os Hy- oides has five on each Side,	Proceed	Inferted.	Nerves, Vessels, &c.
AA	1st	Geniobyoi- deus,	from the lower and inner Part of the Chin,	in the upper Part of the Ba- sis of the Os Hyoides, which it pulls upwards.	
BB	2d	Mylobyoideus	from the inner Part of the Side of the lower Jaw near the Grinders,	in the lateral Part of the Hy- oides-Bone, which it pulls upwards and Side-ways.	
CC	3d	Stylobyoideus,	from the Extremity of the Stylobyoides Process,	in the Cornu of the Hyoides, which it draws aside.	
DD	4th	Coracobyoi- deus,	from the Caracoides Process of the Shoulder-Blade,	in the lower and lateral Part of the Basis of the Hyoides, which it draws Side-ways downwards.	
EE	5th	Sterno-hyo- ideus,	from the inner Part of the first Bone of the Sternum,	in the Basis of the Os Hyoi- des, which it pulls down.	

O B S E R V A T I O N.

Of these ten Muscles of the Os Hyoides, there are five on each Side, to hold it fast in its Situation, and

hinder it from falling to one Side or t'other.— These Muscles are the Instruments wherewith it performs its Motions, which consist in facilitating the Action of Swallowing.

Refer- ence	Number 14.	The Head has seven on each Side.	Proceed	Inferted	Nerves, Vessels, &c.
F	1st	Sterno-Clin- mastoides,	from the upper and lateral Part of the first Bone of the Sternum and the Middle of the Clavicula,	in the upper Part of the Pro- cess Mastoides.— It bows the Head upon the Breast, and makes what we call the Nod.	
G	2d	Splenicus,	from the Tops of the spinal Processes of the five upper- most Vertebrae of the Back, and the three lowermost of the Neck,	in the posterior and lateral Part of the Occiput.	
H	3d	Complexus,	from the transverse Processes of the same Vertebra,	in the posterior and middle Part of the Occiput.— This and the preceding cross one another.	
I	4th	Rectus Ma- jor,	from the Extremity of the acute Process of the 2d Ver- tebra of the Neck,	in the Occiput.	
K	5th	Rectus Mi- nor,	from the first Vertebra of the Neck,	in the Occiput.	
L	6th	Obliquus Ma- jor,	from the Spine of the second Vertebra of the Neck,	obliquely in the transverse Process of the first.	
M	7th	Obliquus Mi- nor,	from the Occiput,	obliquely in the transverse Process of the first Vertebra, at the same Place with the former.	

R E M A R K S.

There are four Muscles on each Side, which raise up the Head, and only one that pulls it down, be- cause the Vertebrae of the Neck, which serve for a Pivot, or Axis to the Head, are not placed directly in the Middle, so that the Weight of the Head lean- ing more forward, one Muscle is sufficient to bow it,

whereas four have enough to hold it up. The two oblique Muscles of the same Side make the Head perform a Semi-circular Motion; because the Head does not move upon the first Vertebra, but upon the second, which has a Tooth-like Process, round which the first Vertebra turns as a Wheel round an Axle-Tree.

Refer- ence.	Number 8.	The Muscles of the Neck are four on each Side.	Proceed	inferted	Nerves, Vessels, &c.
N	1st	Scalenus,	from the upper Part of the first Rib, and from the Cla- vicula,	in the Extremities of the transverse Processes of the three and four uppermost Vertebrae of the Neck.	
O	2d	Longus or Rectus,	from the lateral Part of the Body of the four upper Ver- tebrae of the Back,	in the Body of the upper Vertebra of the Neck, or in the Occiput.	
P	3d	Spinofus,	from the Spinofus Processes of the fourth and fifth upper- most Vertebra of the Back,	in all the Spines of the six Vertebrae of the Neck, which it extends.	

Reference	Number 8.	The <i>Muscles</i> of the Neck are four on each Side,	Proceed	Inserted	Nerves, Vessels, &c.
4th	Q	<i>Transversus</i> ,	from the transverse Processes of the five upper <i>Vertebrae</i> of the Back,	in the Extremity of the third and fourth uppermost <i>Vertebra</i> of the Neck, which it extends.	

R E M A R K S.

Two of these Muscles bend the Neck, and two stretch it out.—When they all act with joint Forces, they keep the Neck firm and strait; and when an *Inflexor* and an *Extensor* act in Concert, they bend the Head to one Shoulder.

In the Interstices of the *Muscles* of the Neck there are the fourteen Jugular Glands, knit to one another by Membranes and Vessels; whose Substance resembles that of the *Maxillares*. Their Office is to separate the Lymph carried off by the lymphatic Vessels of all these Muscles.

Reference	Number 6.	The <i>Shoulder-blade</i> has four Proper, two Common,	Proceed	Inserted	Nerves, Vessels, &c.
P	1st	<i>Trapezium</i> ,	from the posterior Part of the <i>Occiput</i> , from the <i>Spina</i> of the six inferior <i>Vertebrae</i> of the Neck, and the nine uppermost of the Back,	in the whole Spine of the <i>Shoulder-blade</i> , and in the external Part of the <i>Clavícula</i> .	
Q	2d	<i>Rhomboides</i> ,	from the Spine of the three lower <i>Vertebrae</i> of the Neck, and the three superior <i>Vertebrae</i> of the Back,	in the whole <i>Basis</i> of the <i>Scapula</i> , which it pulls backwards.	
R	3d	<i>Levator Proprius</i> ,	by different Heads from the transverse Process of the four upper <i>Vertebrae</i> of the Neck,	in the upper Angle of the <i>Scapula</i> , which it draws up.	
S	4th	<i>Pectoralis Minor</i> ,	by Way of Digitation from the second, third, and fourth upper Ribs of the <i>Thorax</i> ,	in the <i>Coracoides</i> Process of the <i>Scapula</i> , which it pulls forwards.	

R E M A R K S.

The two common *Muscles* of the *Shoulder-Blade*, are the *Latissimus*, and *Profundus*, which though designed for the Arm, fasten upon the *Shoulder-Blade* as they pass, and in some Measure assist it in its Motions.

The superior Limb, is divided into the Arm, the *Cubitus*, and the Hand. The Arm is that Part that lies between the Shoulder and the Elbow. The *Cubitus* is limited by the Elbow and the Wrist; the Hand, by the Wrist and the Top of the Fingers; these Parts are moved by several Muscles, of which in Order.

Reference	Number 9	The <i>Arm</i> has	Proceed	Inserted	Nerves, Vessels, &c.
T	1st	<i>Deltoides</i> , from the Resemblance of a Greek Δ ,	from the <i>Clavícula</i> , the <i>Acronium</i> , and the whole Spine of the <i>Shoulder-blade</i> ,	with a strong Tendon almost in the Middle of the Arm,	Compounded of 12 simple Muscles.
V	2d	<i>Supraspinatus</i> ,	from the external Part of the <i>Basis</i> of the <i>Shoulder-blade</i> ,	under the Neck of the <i>Shoulder-bone</i> , it encompasses with a broad Tendon, and moves upwards.	
X	3d	<i>Latissimus</i> ,	from the three of four inferior <i>Vertebrae</i> of the Back, from all the <i>Vertebrae</i> of the Loins, from the Spine of the <i>Os Sacrum</i> , the posterior Part of the Edge of the <i>Os Illium</i> , and the external Part of the inferior short Rib,	in the upper and internal Part of the <i>Shoulder-bone</i> , which it pulls downwards.	
Y	4th	<i>Rotundus Major</i> ,	from the external Part of the inferior Angle of the <i>Scapula</i> ,	with the <i>Latissimus</i> , in the upper and internal Part of the <i>Shoulder-bone</i> , which it pulls downwards.	
Z	5th	<i>Pectoralis Major</i> ,	from the Middle of the <i>Clavícula</i> , upon that Side that faces the <i>Sternum</i> , and from the lateral and middle Part of the <i>Sternum</i> ,	by a short Tendon in the upper and fore Part of the <i>Shoulder-bone</i> .—It moves the Arm forwards.	
I	6th	<i>Coracoides</i> ,	from the <i>Coracoides</i> Process of the <i>Scapula</i> ,	in the Middle and inner Part of the <i>Shoulder-bone</i> . It moves the Arm forwards,	Its Belly is perforated to give Way to the Nerves that repair to the Muscles of the <i>Cubitus</i> .

Reference

Reference	Number 9.	The Arm has	Proceed	Inserted	Nerves, Vessels, &c.
2	7th	<i>Sub-Spinatus</i> ,	from the outer Part of the <i>Basis</i> of the <i>Scapula</i> ,	in the upper back Part of the Shoulder-bone, which it draws back.	
3	8th	<i>Rotundus Minor</i> ,	from the lower Side of the <i>Scapula</i> , near its anterior Corner,	in the posterior and superior Part of the Shoulder-bone, which it moves backwards.	
4	9th	<i>Sub-Scapularis</i> ,	from the inner <i>Labium</i> of the <i>Basis</i> of the <i>Scapula</i> ,	in the inner and superior Part of the Shoulder-bone, which it draws close up to the Ribs.	

REMARKS.

By Virtue of these, the *Arm* performs five Sorts of Motions; two, viz. the *Deltoides*, and *Supraspinatus* lift it up; two, the *Latissimus*, and *Rotundus Major* draw it down; two, the *Pectoralis Major*, and *Coracoideus* pull it forwards; two, the *Infra Spinatus*,

and *Rotundus Minor* pull it back; and one, viz. the *Scapularis* draws it into the Side of the Body.—The alternate Actions of the first eight Muscles, move the *Arm* round.

The *Cubitus* is divided into two Parts, viz. the *Ulna* and the *Radius*, each of which has their separate Motions, and consequently peculiar *Muscles*.

Reference	Number 6	The Ulna has	Proceed	Inserted	Nerves, Vessels, &c.
4	1st	<i>Biceps</i> ,	from the <i>Caracoides</i> Process, and from the upper Part of the cartilaginous Edge of the glenoides Cavity of the <i>Scapula</i> ,	by one Tendon in a Knob, at the upper, and inner Part of the <i>Radius</i> . It bows the <i>Arm</i> .	
5	2d	<i>Brachialis internus</i> ,	from the anterior and superior Part of the Shoulder-bone,	in the superior and inner Part of the <i>Ulna</i> .—It bows the <i>Cubitus</i> , in Conjunction with the <i>Biceps</i> .	
6	3d	<i>Longus</i> ,	from the superior Part of the <i>Scapula</i> , near its Neck.	by a strong Tendon in the <i>Olecranon</i> .	
7	4th	<i>Brevis</i> ,	from the superior and posterior Parts of the <i>Humerus</i> ,	in the <i>Olecranon</i> .	
8	5th	<i>Brachialis Externus</i> ,	from the posterior Part of the <i>Humerus</i> ,	in the <i>Olecranon</i> , by the same Tendon with the two last <i>Muscles</i> .	
9	6th	<i>Anconeus</i> ,	from the lower Part of the <i>Condylus</i> or Shoulder-bone,	by a Tendon in the lateral and back Part of the <i>Ulna</i> , about two or three Fingers Breadth under the Elbow.	

REMARKS.

The *Ulna* has only two Sorts of Motion, viz. that of Flexion, or Bowing, and that of extending itself.

The first it compasses by Means of the *Biceps*, and *Brachialis Internus*, and the other by the the Help of the *Longus*, *Brevis*, *Brachialis Externus*, and *Anconeus*.

References	Number 4	The Radius has two Pronatores, two Supinatores.	Proceed	Inserted	Nerves, Vessels, &c.
Pronatores 10	1st	<i>Rotundus</i> ,	by a carnos Head from the internal Process of the Shoulder-bone,	obliquely in a membranous Tendon upon the Outside of the <i>Radius</i> , a little below the Middle.	
Supinatores 11	2d	<i>Quadratus</i> ,	from the inferior and almost external Part of the <i>Ulna</i> ,	in the lower and external Part of the <i>Radius</i> .	
12	1st	<i>Longus</i> ,	about three or four Fingers Breadth above the outer Process of the Shoulder-bone,	in the inner Part of its inferior Process.	
13	2d	<i>Brevis</i> ,	from the lower Part of the inferior and external <i>Condylus</i> of the Shoulder-bone,	in the superior and anterior Part of the <i>Radius</i> .	

REMARKS.

The *RADIUS* has two Sorts of Motion, one called *Pronatio*, whereby the Palm of the Hand, with the Help of the two *Pronatores* Muscles, is turned down; and the other *Supinatio*, in which the two *Supinatores* turn it upwards.

The *HAND* is the third Part of the superior Limbs; it commences from the Articulation of the Wrist, and terminates at the Fingers ends.—Its inner Part is called the Palm, and the outer the Back of the Hand.—'Tis divided into the *Carpus*, or *Wrist*, the *Metacarpus*, and the *Fingers*.

Reference	Number 6	The <i>Carpus</i> has 3 to bend and 3 to extend it.	Proceed	Inserted	Nerves, Vessels, &c.
Flexores					
14	1st	<i>Cubitus Externus</i> ,	from the lower and interior <i>Condylus</i> of the Shoulder-bone,	by a thick Tendon in the small Bone of the <i>Carpus</i> , that lies above the rest.	
15	2d	<i>Radius Internus</i> ,	from the lower and inner <i>Condylus</i> of the Shoulder-bone,	in the first Bone of the <i>Carpus</i> , that supports the Thumb.	
16	3d	<i>Palmaris</i> ,	from the lower and interior <i>Condylus</i> of the Shoulder-bone,	in the Skin of the Palm of the Hand.	
	Zatuders				
17	1st	<i>Cubitus Externus</i> ,	from the posterior Part of the <i>Ulna</i> ,	in the superior and external Part of the Bone of the <i>Metacarpus</i> , that supports the little Finger.	
18	2d	<i>Longus</i> ,	from the interior Part of the Shoulder-bone,	in that Bone of the <i>Carpus</i> , that supports the fore Finger.	
19	3d	<i>Brevis</i> ,	from the lowermost Part of the Shoulder-bone,	in the Bone of the <i>Carpus</i> , that answers the middle Finger.	

REMARKS.

Besides these six *Muscles*, three of which serve to bend, and three to extend the *Carpus* or *Wrist*, it has also a Ligament called *Annular*, which surrounds it like a Bracelet; this Ligament serves not only to join the two Bones of the *Cubitus*, in the Neighbourhood of the Wrist, but likewise to hold fast all the Tendons of the *Muscles*, and prevent their slipping out of their Place when they are in Action.

We find also, at the Root of the Hand, under the *Mons Veneris*, a certain Musculous Heap of Flesh in a square Form, which begins at the *Thenar*, and

ends in the eighth Bone of the *Carpus*. Some allege, that it serves to render the Hand hollow, by drawing towards the *Thenar*, the fleshy Eminence that lies under the little Finger.

The FINGERS have three and twenty *Muscles*; thirteen of which are common, and ten proper; the common ones, viz. the *Sublimis*, *Profundus*, *Extensor Communis*, the four *Lumbricales*, and the six *Interossei*, serve all the Fingers; the proper ones, are those peculiarly calculated for each Finger, viz. five for the Thumb, three for the fore-Finger, and two for the little Finger, and are situated as follow.

Reference	Number 23	The <i>Muscles</i> of the Fingers are	Proceed	Inserted	Nerves, &c.
The Common.					
20	1st of the Benders.	<i>Sublimis</i> ,	from the inner Part of the inferior and interior <i>Condylus</i> of the Shoulder-bone,	in the second Row of the Bones of the four Fingers, being fastened in its Passage to those of the first,	divided into four Tendons.
21	2d	<i>Profundus</i> ,	from the upper and interior Part of the <i>Ulna</i> , and the <i>Radius</i> ,	in the third Row of the Bones of the Fingers,	divides into four Tendons.
22	3d	<i>Extensor communis Major</i> ,	from the posterior Part of the external and inferior <i>Condylus</i> of the Shoulder-bone,	in the second and third <i>Phalanx</i> ,	before its Arrival at the Wrist, divides itself into four flat membranous Tendons.
	4th, 5th, 6th, 7th	four <i>Lumbricales</i> ,	from the <i>Tendons</i> of the <i>Profundus</i> , and the annular <i>Ligament</i> ,	in the second Articulation of the Fingers, for their Abduction,	
	8th, 9th, 10th	three <i>Offei Interni</i> ,	from the superior Part of the Interstices, between the four Bones of the <i>Metacarpus</i> ,	in the lateral Part of the Bones of the Fingers, which they move towards the Thumb,	They join their Tendons with those of the <i>Lumbricales</i> .
	11th, 12th, 13th	<i>Offei Externi</i> ,	for the same Interstices of the Bones of the <i>Metacarpus</i> ,	in the last Articulation of the Bones of the Fingers.	

REMARKS.

The Tendons of the *Sublimis*, and *Profundus*, are very strong, because the true Action of the Hand is performed by them.—The Tendons of the *Sublimis*, are perforated to give Way to those of the *Rotundus*, to the End that the Flexion of the Fingers may be circular, and stronger.—Those Tendons are enclosed in a long, strong, and membranous Sheath, which hinders 'em to fly off to the Right or Left, or to

raise up against the Palm of the Hand, in their Motions; which Sheath contains a fat and oily Humour, that moistens them.

The *Tendons* of the *Communis Major*, are flat, that they may jut out less upon the Back of the Hand, thro' which they pass, for that Part had been deform'd if these Tendons had been round.

There is but one *Extender Muscle* for two *Benders*, because the Strength of the Hand consists in its Flexion.

Reference

Reference	Number	The THUMB has five peculiar Muscles,	Proceed	Inferted	Nerves, Tendons, &c.
23	1st	<i>Flexens Proprius,</i>	from the superior and interior Part of the <i>Radius</i> ,	in the first and second Bone of the <i>Thumb</i> , which it bends.	by a forked Tendon.
24	2d	<i>Longus,</i>	from the upper and outer Part of the <i>Ulna</i> ,	in the second Bone of the <i>Thumb</i> which it stretches out,	
25	3d	<i>Brevis,</i>	from the same Place with the <i>Longus</i> ,	in the third Bone of the <i>Thumb</i> , which it serves, also, to stretch out.	
26	4th	<i>Thenar,</i>	from the first Bone of the <i>Wrist</i> , and the annular Ligament,	in the second Articulation of the <i>Thumb</i> , which it removes from the other Fingers.	
27	5th	<i>Antithenar,</i>	from the Bone of the <i>Metacarpus</i> , that supports the middle Finger,	in the first Bone of the <i>Thumb</i> , which it pulls to the other Fingers.	

REMARKS.

Of these five Muscles, one of them bend or bows the *Thumb*, two extend it, one draws it away from the other Fingers, and one pulls it towards them.

Reference	Number	The Fore-finger has	Proceed	Inferted	Nerves, Tendon, &c.
28	1st	<i>Indicator,</i>	from the middling and posterior Part of the <i>Ulna</i> ,	in the second <i>Phalanx</i> of the Index or Fore-finger, and in the Tendon of the <i>Extensor Major</i>	by a double Tendon.
	2d	<i>Indicis Adductor,</i>	from the Fore-part of the first Bone of the <i>Thumb</i> ,	in the first Bone of the <i>Fore-finger</i> , which it draws towards the <i>Thumb</i>	
	3d	<i>Indicis Abductor,</i>	from the external and middling Part of the <i>Ulna</i> ,	in the lateral and outer Part of the Bones of the <i>Index</i> , which it pulls toward the other three Fingers	

REMARKS.

By virtue of these three Muscles, the *Fore-finger* performs three Sorts of Motion; one of them stretches it, another brings it in to the *Thumb*, and the third removes it from the *Thumb*.

Reference	Number	The Little-finger has	Proceed	Inferted	Nerves, Tendons, &c.
29	1st	<i>Extensor Proprius,</i>	from the lower Part of the exterior <i>Condylus</i> of the Shoulder Bone,	in the second Articulation of the <i>Little-Finger</i> , it assists the <i>Extensor Communis</i> in stretching out the <i>Little-Finger</i> ,	by a double Tendon.
	2d	<i>Hypothenar,</i>	from the little Bone of the <i>Carpus</i> that lies above the rest	on the Out-side of the first Bone of the <i>Little finger</i> , which it pulls away from the rest.	

REMARKS.

With these two Muscles the *Little-finger* is capable of Extension and Abduction; since one of them extends it, and the other enlarges its Distance from the other Fingers.

Having thus examined all the Muscles of the superior Limbs, I must be obliged, to satisfy entirely the Curiosity of the Reader, and render this Course of *Anatomy* as perfect as I can, to proceed to the Examen of the Nerves, Arteries, and Veins we meet with in the Arm.

We have observed already, that the Nerves proceed from the *Medulla Oblongata*, and the *Medulla Spinalis*. The first sends forth ten Pair of Nerves, which we have seen, and the second thirty more, which we are to see.

Of the thirty Pair which proceed from the *spinal Marrow*, seven belong to the Neck, twelve to the Back, five to the Loins, and six to the *Os Sacrum*.

The first Pair of the *Cervical Nerves* arise between the first and second *Vertebra* of the Neck, and contrary to the rest comes out before and behind; whereas the other six Pair come out laterally from the Juncures of the *Vertebrae*, thro' particular Perforations near the transverse *Processus*.—They go to the Muscles of the Head and Ears.

The second Pair contributes the main Branch towards the Formation of the *Diaphragmatick Nerves*, which, according to *Vicussens*, spring only from the fourth and sixth Pair.

The three last Pair of the Neck, joining with the two first of the *Dorsum*, or Thorax, make the *Brachial Nerves*.

These *Brachial Nerves* are six in Number, which range all over the Arm to the very Fingers Ends.

(32) The first, which is the uppermost, and least, is spent upon the *Deltoides* Muscles and the Skin of the Arm.

(33) The second is larger, and passes through the Middle of the Arm. It detaches Branches to the *Biceps* and the *Supinator*; and when it arrives at the Cubit divides it into three Branches, the first of which marches by the outer Part of the Arm to the Thumb; the second descends obliquely to the Wrist; and the third keeping Company with the *Basilica*, runs to its Period in the Skin of the *Cubitus* and the Hand.

(34) The third joins the second under the *Biceps*, furnish the Muscles called *Brachiales*, with some of its Branches, the Thumb, Fore-finger, and Middle-finger, with small Twigs, and is spent upon the Benders of the Fingers.

(35) The fourth, which is the greatest of all, lies very deep in the Arm, and accompanies the Artery and

and Vein, called the *Basilica*. It dispenses Shoots to the external Muscle of the *Cubitus*, and the Skin of the Inside of the *Arm*; but as soon as it arrives at the Elbow, it splits into two Branches, one of which glides along the *Radius*, and the other the *Ulna*.—The first of these sends out five Branches, two of which repair to the *Thumb*, two to the Fore-finger, and the fifth to the Middle-finger.—The other Branch dispatches Twigs to the Extenders of the Fingers, and then is lost in the Wrist.

(36) The fifth joins in with the fourth, and descending along the inner Part of the *Arm*, distributes Branches upon the *Ulna*; and from thence it comes to pass, that when one leans upon any of these Branches, the *Arm* is benumbed.—Then it is divided into two Branches, one of which visits the Benders of the Fingers and the Wrists, and loses the Remainder in the same Quarter with the former; the other creeps along the inner and lateral Side of the *Arm*, in order to send two Branches to the Little-finger, two to the Ring-finger, and one to the Middle-finger.

(37) The sixth, and last, almost all over cutaneous, descends along the inner Part of the *Arm*, in company with the *Basilica*, and is lost in the Skin of the Elbow and *Cubitus*.

The *Arms* are also provided with Arteries and Veins.—The *Arteries* have their Origin from the ascending great Artery, which divides itself into the right and left *Subclavian*, which passing through the Chink that lies between the two Heads of the *Scalenum* Muscle, proceeds to the *Arm*; and at the Arm-pits, is called *Axillary Artery*, which passing under the Head of the Shoulder Bone, is lost between the two Extenders of the *Cubitus*.

The Trunk itself continuing its Descent along the inner Part of the *Arm*, dispenses Branches to the *Biceps*, and the *Brachieus Internus* and *Externus*, and above the Bending of the Elbow sends out a Twig, which is lost in the Interior, and back Part of the inner and lower Part of the *Arm*.

(40) At the Bending of the Elbow this arterious Trunk splits into two Branches, one internal, and the other external.

(41) The External creeps along the *Radius*, and shoots forth a Branch which re-ascends, and comes to a Period between the *Supinator Longus* and *Brachieus Internus*. In its Descent it distributes Branches to the Benders of the Wrist and Fingers. At the Wrist it affords a Branch to the Head of the *Thenar*, which is the Artery we meet with when we feel the Pulse. After that it slides under the Tendon of the Extender of the Thumb, and having bestowed Branches on the outside of the *Hand*, terminates into two Shoots, one of which runs to the Thumb, and the other to the Fore-finger.

We must trace the *Veins* in a different manner from the *Arteries*; for as the *Arteries* import the Blood from the Heart to the Circumference, so the *Veins* export it from the Circumference to the Heart; therefore they have both a different Origin. The *Arteries* of the *Arm* proceeding like those of the

other Parts from the Heart; and the *Veins* of the *Arm* from the Extremities of the Fingers, like the Roots of a Tree, which by their smallest Strings receive the Sap, in order to convey it to the bigger Roots, and from thence to the Trunk itself.

The *Cephalica*, *Basilica* and *Mediana*, are the three considerable Veins of the *Arm*, form'd from several Branches of *Veins* proceeding from the five Fingers.

(44) The *CEPHALICK* consists of some small Branches, which form a Vein between the Little and the Ring-finger, called *Salvatella*. It lies between the Skin and the Muscles, and is divided into two Branches, *External* and *Internal*. The External goes down to the Wrist, where it joins the *Basilica*, and turns up to the Back of the Hand. The Internal Branch, together with a Sprig of the *Basilica*, makes the *Mediana*.

It is thus called, in regard the Antients used to open it in the Disorders of the *Head*; from a mistaken Notion, that it had a nearer Concern with the *Head* than any of the other *Veins*.

(45) All the little Veins which spring from the five Fingers to the *Hand*, form that great Vein which runs the whole Length of the *Arm*, and is called *BASILICA*, from its being seated almost on its *Basis*.—The *Basilica* is divided into three great Branches, one of which is usually opened when we are blooded in the *Arm*, as being the more superficial and apparent.—The other is deeper, and consists of two Branches, one directing its Course to the inner Part of the *Hand*, and the other to the outer.—The third is the *Cubitalis*, which lies nearest the *Os Cubiti*.—These three Branches ascend towards the *Arm*, and in the Way receive a Vein from the *Median*, after which they slip under the Tendon of the Pectoral Muscle, and unload in the Axillary Vein.

From a Branch which arises between the Thumb and the Fore-finger, joined to another that springs between the Middle and Ring-finger, is formed a large Vein, which ascends along the Middle of the *Arm* to the Bending of the Elbow, called the *MEDIANA*, which afterwards divides itself into two Branches in the Form of an Y, one of which terminates in the *Cephalica* and the *Basilica*, where it is lost; while the *Cephalica* and *Basilica* continue their Course to the Axillary, where they unload themselves, the *Axillary* into the *Subclavian*, and the *Subclavian* into the *Cava*.

Before we examine the *Muscles* of the inferior Limbs, we must take some Notice of those employ'd in the Dilatation and Contraction of the *Thorax*, which amount to fifty seven. Thirty thereof, in the Opinion of the Antients, serve for the Dilatation of the Breast, fifteen on each Side, viz. the *Subclavian*, *Serratus Major*, two *Serrati Posteriores*, and eleven *Interossei Externi*; and twenty six, thirteen of each Side for its Contraction, viz. the *Triangularis*, *Sacro-lumbaris*, and eleven *Interossei Interni*; the *Diaphragm* employ'd indifferently in both Motions, being the fifty seventh.

Reference	Number 57	The Muscles of the Thorax or Breast.	Proceed	Inserted	Nerves, Vessels, &c.
Dilators AA	1st	<i>Subclavian</i> ,	from the Internal and inferior Part of the <i>Clavicula</i> ,	in the upper Part of the first Rib, which it pulls upwards and outwards.	
BB	2d	<i>Serratus Major</i> ,	from the internal Basis of the Shoulder-blade,	by Digitation in the five lower-most long Ribs, and the two upper-most short ones; it pulls the Ribs outwardly and dilates the Breast.	
CC	3d	<i>Serratus posterior and superior</i> ,	in a broad Tendon from the acute Processes of the lower-most <i>Vertebrae</i> of the Neck, and from the first of the Loins,	in four Points in the lower-most Ribs, to pull them down and outward.	

Reference	Number 23	The Muscles of the Thorax or Breast.	Proceed	Inserted	Nerves, &c.
EE	11 in all 15 Dilators.	<i>Intercostales Externi,</i>	from the inferior and external Part of each upper Rib,	obliquely from behind forwards in the superior and external Part of each of the lower Ribs, which they pull backwards, and outwards, to promote the Dilatation.	
F	Contrac- tors. 1st	<i>Triangularis,</i>	from the lower Part of the Sternum on which it lies,	in the Cartilages of the superior Rib, reaching even the Twelfth. It draws the Ribs downwards, and contracts the Breast.	
GG	2d	<i>Sacrolumbaris,</i>	from the posterior Part of the Os Sacrum, and the Spine of the Vertebrae of the Loins,	in the posterior Parts of the Ribs near the Root; by its Tendons contract the Breast,	bestows two Tendons on each Rib, one on the Outside, and one on the Inside.
	11	<i>Intercostales Interni.</i>	from the upper Part of each lower Rib,	in the inferior and interior Edge of each upper Rib, they contract the Breast in Conjunction with the two last mentioned.	

REMARKS.

Some modern Anatomists are of Opinion that the internal and external Intercostal Muscles, make but one Muscle, which has two Plans of Fibres with contrary Directions.

The Action of these Muscles is effected in this Manner. When the internal Air is press'd by the external, the Diaphragm, being forced thereby to dilate itself, the dilating Muscles are also in Action; and when that Air, after having passed through the Lungs, is forced to sally out, the Diaphragm contracts itself, as well as the Muscles Antagonists to those that acted before; though some of our modern Anatomists believe, that it is not the Air that causes the Dilatation, or Contraction of the Muscles of the Thorax, but the Dilatation and Contraction of those Muscles that procure the Ingress and Egress of the Air, into or out of the Breast.

(H) The Diaphragm, which is the principal Organ of the Respiration, also called *Septum transversum*, is a nervous Muscle, separating the Breast or Thorax from the Abdomen, or lower Venter, and serving as a Partition between the natural and vital Parts.—Its Figure is round, resembling a Ray or Thornback.—It consists of two Circles, the one membranous, the other fleshy. Though others will have both of them muscular.

The first, or superior Circle arises from the Sternum, and the Ends of the last Ribs; the second or inferior comes from the Vertebrae of the Loins. The Upper is covered a-Top with a Membrane derived from the Pleura; and the Lower lined at Bottom with another from the Peritonaeum (I).

Its Situation is Oblique, being extended from the

Cartilage *Xiphoides*, by the Extremes of the Ribs, to the Region of the Loins.

(L) It is pierced in the Middle for the Passage of the *Vena Cava*; and in its lower Part for the *Oesophagus*; and between the Productions of the inferior Circle pass the *Aorta*, *Thoracic Duct*, and *Vena Azygos*.

(MM) It receives two Sorts of Nerves, one from the *Parvagus*, and the other from the Interstices of the four lowermost Vertebrae of the Neck. Both the one and the other pass through the Cavity of the Thorax, and being supported by the *Mediastinum*, are dispersed in three or four Branches all over its Substance.

It receives likewise two Arteries, called *Phrenicae*, which spring from the Trunk of the *Aorta*; and two Veins of the same Name, which march to the Trunk of the *Cava*.

The Diaphragm, in its natural Disposition, is convex on the upper Side towards the Breast, and concave on the lower; towards the Abdomen. Hence it has two Motions, the one of Contraction, and the other of Relaxation.

By the Contraction, or Swelling of the Fibres, the Diaphragm becomes flat on each Side; the Consequence of which is, that the Cavity of the Breast is enlarged to give Liberty for the Lungs to receive the Air in Inspiration; and the Cavity of the Abdomen lessened, and consequently the Stomach and Intestines pressed, for the Distribution of the Chyle.—In its Relaxation, whereby it resumes its natural Situation, the Cavity of the Breast is diminished, and the Lungs pressed, for the Expulsion of the Air in Expiration.

On the Diaphragm also, in great Measure, depends the Action of Coughing, Sneezing, Yawning, Laughing, the Hiccups, &c.

Reference.	Number 6.	The Muscles of the Back and Loins are	Proceed	Inserted.	Nerves, Vessels, &c.
P	Extenders 1st	<i>Sacer,</i>	from the posterior Part of the Os Sacrum, and the posterior and superior Edge of the Os Ilium,	in the Spines of the Vertebrae of the Back.	
Q	2d	<i>Semispinatus,</i>	from the Spines of the Os Sacrum, and from those of the Vertebrae of the Loins,	obliquely in all the transverse Processes of the Vertebrae of the Back, reaching even to the Neck.	
P	Bender of the Loins.	<i>Triangularis,</i>	from the posterior Part of the Costa of the Os Ilium, and the lateral, internal Part of the Os Sacrum,	in the last of the short Ribs, and in all the transverse Processes of the Vertebrae of the Loins with its Fellow, it bends the Back-bone forwards.	

REMARKS;

REMARKS.

These six Muscles are common to both the Back and the Loins, in their Extension, Flexion, and bending Side-ways.

The *Semi-spiratus*, *Sacer*, and *Sacro-lumbaris*, seem to make but one Body or Mass of Flesh, which covers the whole Back from the *Os Sacrum* to the Neck.

These are the Muscles that grace the Mein and Carriage of Women, by keeping their Body very strait, and when they neglect their Parts, either through Weakness or an ill Custom, the Body stoops, and sometimes becomes Hunch-backed.

The *inferior Limb* (called *Pes*) is divided like the superior into three Parts, viz. the *Thigh*, the *Leg*, and the *Foot*.—In the *Thigh* are distinguished the Fore-part, the Back-part, the Inside and the Out-side. —The Fore-part of the inferior End is called the Knee, and the Hinder-part the *Ham*.

The *LEG* begins at the Knee, and ends at its Articulation with the Foot, on each Side thereof, are the two Prominences, called *Malleoli*, or *Angles*.—Its Back-part is called the Calf of the *Leg*.

The *FOOT*, which is that Part that extends from the Ankles to the End of the Toes (and whose upper Part is called the *Cubitus* or *Instep*, and the lower, the Sole of the *Foot*) is divided into the *Tarsus*, *Metatarsus*, and the *Toes*, as we have observed, already, in our *Osteology*.—These three Parts are assisted in their Motions by several Muscles.

The *THIGH*, in its Flexion, or Bending by the *Psoas*, *Iliacus*, and *Pectineus*; in its Extension by the three *Glutæi*; in its Adduction by the three *Tricipites*; in its Abduction by the *Pyramidalis*, the *Quadratus*, and the two *Gemini*; and in its *Rotation* by the two *Obturatores*, which make in all fifteen Muscles.

Reference	Number 15	The Thigh has	Proceed	Inserted	Nerves, Vessels, &c.
S	1st Benders.	<i>Psoas</i> ,	from the transverse Processes of the lowermost <i>Vertebrae</i> of the Back, and the uppermost of the Loins,	with a strong and round Tendon in the lesser <i>Trochanter</i> ,	seated in the <i>Abdomen</i> .
T	2d	<i>Iliacus</i> ,	from the whole Edge of the inner Cavity of the <i>Os Ilium</i> ,	in the little <i>Trochanter</i> ,	seated in the <i>Abdomen</i> .
V	3d	<i>Pectineus</i> ,	from the first Part of the <i>Os Pubis</i> ,	in the fore Part of the <i>Thigh-Bone</i> , under the little <i>Trochanter</i> . These three Muscles make the Thigh bend.	
X	1st Extenders.	<i>Glutæus Major</i> ,	from the lateral Part of the <i>Os Sacrum</i> , and from the hinder and outer Part of the Lip of the <i>Os Ilium</i> ,	in the Bone of the Thigh, about the Breadth of four Fingers under the great <i>Trochanter</i> .	
Y	2d	<i>Glutæus Intermedius</i> ,	from the posterior Part of the Lip of the <i>Os Ilium</i> ,	about three Fingers Breadth under the great <i>Trochanter</i> .	
Z	3d	<i>Glutæus Minor</i> ,	from the deepest and hol-lowest Part of the external Cavity of the <i>Os Ilium</i> ,	in a little Cavity at the Root of the great <i>Trochanter</i> . These three stretch out the Thigh.	
1	1st <i>Abduc-tores</i> .	<i>Triceps Superior</i> ,	from the upper and outer Part of the <i>Os Pubis</i> ,	in the upper Part of a Line that runs along the Inside of the Thigh.	
2	2d	<i>Triceps Medius</i> ,	from the Middle of the <i>Os Pubis</i> ,	in the Middle of the same Line.	
3	3d	<i>Triceps Inferior</i> ,	from the inferior Part of the <i>Os Pubis</i> and the lower Part of the <i>Os Ischium</i> ,	in the inferior Part of the same Line.	
	1st <i>Abduc-tores</i> .	<i>Pyramidalis</i> ,	from the upper and lateral Part of the <i>Os Sacrum</i> , and the lateral Part of the <i>Os Ilium</i> ,	in a small Cavity at the Root of the great <i>Trochanter</i> .	
4	2d	<i>Quadratus</i> ,	from the outer and lateral Part of the rising Part of the <i>Ischium</i> ,	in the posterior and external Part of the great <i>Trochanter</i> .	
	3d, 4th	<i>Gemini</i> ,	from the two little Processes in the hinder Part of the <i>Os Ischium</i> ,	in a small Cavity at the Root of the great <i>Trochanter</i> . They join with the <i>Quadratus</i> in opening the Thigh, by a Tendon in a small Cavity at the Root of the great <i>Trochanter</i> .	separated by the Tendon of the <i>Obturator Internus</i> .
	1st <i>Obtura-tores</i> .	<i>Obturator Internus</i> ,	from the whole Circumfe-rence of the oval <i>Foramen</i> of the <i>Os Ischium</i> ,	by the Cavity at the Root of the great <i>Trochanter</i> . These two Muscles serve for the Rotation of the <i>Thighs</i> .	
	2d	<i>Obturator Externus</i> ,	from the outer Circumfe-rence of the same Hole,		

Refer-ence.	Number 11	The Tibia or Leg has	Proceed	inserted	Nerves, Vessels, &c.
5	four Ex-tensors. 1st	<i>Rectus</i> ,	from the fore and lower Part of the <i>Os Ilium</i> ,	in the upper and fore Part of the <i>Leg</i> ,	comes to a Ten-don, and covers the whole <i>Rotu-la</i> , or Knee-Pan.

Reference	Number 20	The <i>Tibia</i> , or <i>Leg</i> has	Proceed	Inserted	Nerves, Vessels, &c.
6	2d	<i>Vastus Inter-</i> <i>nus</i> ,	from the inner and upper Part of the <i>Femur</i> , a little below the lesser <i>Trochanter</i> ,	in the superior and interior Part of the <i>Tibia</i> ,	marches in a broad Tendon.
7	3d	<i>Vastus Exter-</i> <i>nus</i> ,	from the upper and fore-Part of the Thigh-bone,	with the former.	
8	4th three Benders.	<i>Cruralis</i> ,	from the anterior and supe- rior Part of the Thigh be- tween the two <i>Trochanters</i> ,	along with the three I men- tioned last. These four stretch out the <i>Leg</i> by pul- ling it forwards.	
9	1st	<i>Biceps</i> ,	from the lower Part of the Knob of the <i>Os Ischium</i> , and the outer Part and Middle of the Thigh,	in the upper and hinder Part of the superior Appendage of the <i>Perone</i> .	
10	2d two <i>Ab-</i> <i>ductores</i> .	<i>Semi-ner-</i> <i>vofus</i> ,	from the Knob of the <i>Os Is-</i> <i>chium</i> ,	in the hinder Part of the up- per <i>Epiphysis</i> of the <i>Tibia</i> . These three <i>Muscles</i> bend the <i>Leg</i> by pulling it back- wards.	
12	1st	<i>Longus</i> ,	from the upper and anterior <i>Spina</i> of the <i>Os Ischium</i> ,	obliquely in the internal and superior Part of the <i>Tibia</i> , which it pulls in.	
13	2d two <i>Ab-</i> <i>ductores</i> .	<i>Gracilis</i> ,	from the lower and fore-Part of the <i>Os Pubis</i> ,	in the upper and inner Part of the <i>Tibia</i> . These two perform the <i>Adduction</i> of the <i>Leg</i> by pulling it inwards.	
14	1st	<i>Membrano-</i> <i>fus</i> ,	for the external and lateral Part of the Lip of the <i>Os-</i> <i>Ilium</i> ,	by a broad Membrane in the upper and outer Part of the <i>Fibula</i> .	
15	2d	<i>Popliteus</i> ,	from the outer and lower Knob of the <i>Femur</i> ,	obliquely in the superior and interior Part of the <i>Tibia</i> . These two <i>Muscles</i> form the <i>Abduction</i> of the <i>Leg</i> by drawing it to the Out-Side.	

Reference	Number 9.	The Foot has	Proceed	Inserted	Nerves, Vessels, &c.
16	two Flex- ores. 1st	<i>Crureus An- terior,</i>	from the upper and fore-Part of the <i>Tibia</i> ,	by two Tendons, one to the first Wedge-like Bone, and the other to the Bone of the <i>Metatarsus</i> that supports the great Toe.	This is called the Tendon of <i>Achil- les</i> , because 'tis said he died of a Wound in that Place, which is always very dan- gerous.
	17				
18	seven Ex- tenfores 1st 2d	<i>Gemelli,</i>	from the posterior of the two lower <i>Condili</i> of the Thigh- bone,	by a Tendon common to them, and the two follow- ing <i>Muscles</i> , in the posterior and superior Part of the Bone of the Heel. These with the two following form the Calf of the Leg.	
	19				
	4th	<i>Plantaris,</i>	from the outer Knob of the Bone of the Thigh,	by confounding its slender Tendon with that of the three last in the same Place with them,	
	20	5th	<i>Crureus Poste- rior,</i>	from the posterior Part of the <i>Tibia</i> ,	
21	6th, 7th	<i>Peronei Po- steriores,</i>	the first from the upper, and very near the fore-Part of the <i>Perone</i> ,	in the upper, and in a man- ner the external Part of the Bone of the <i>Metatarsus</i> that supports the great Toe.	
			the second from the lower- most Part of the <i>Perone</i> ,	in that Bone of the <i>Metatar- sus</i> that supports the little Toe. They stretch out the Foot by pulling it backwards,	

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The Reason why that skilful Artist, Nature, has introduced into the Mechanism of the Foot but two Flexores, for seven Extensores, is, that such a great Number of Muscles that draw the Foot back, and keep a Man from falling forwards, was necessary to counterpoise the Center of Gravity; and two were

sufficient for bending the *Foot*, which naturally bend but too much.

Two and twenty Muscles are assigned for the Motion of the Toes, of which sixteen are common, viz. two *Extensores*, two *Flectentes*, four *Lumbricales*, and eight *Interossei*; and six proper, viz. four for the great *Toe*, one for the second, and the sixth for the little *Toe*.

Reference	Number 22.	The Toes have	Proceed	Inserted	Nerves, Vessels, &c.
22	two Ex- tensors. 1st	<i>Extensor Communis,</i>	from the upper and fore-Part of the <i>Tibia</i> , where it joins the <i>Fibula</i> ,	by four Tendons in the four Articulations of the four <i>Toes</i> , which it extends.	
23	2d	<i>Pedius,</i>	from the lower Part of the <i>Fibula</i> and the annular Liga- ment,	divided into four Tendons in the outer Part of the first Articulation of the four <i>Toes</i> . They both perform the Extension.	
24	two Flex- ores. 1st	<i>Sublimis,</i>	from the lower and inner Part of the Heel-bone,	divided into four perforated Tendons, in the upper of the first Rank of the Bones of the four <i>Toes</i> , in order to bend them.	
25	2d	<i>Profundus,</i>	from the superior and poste- rior Part of the <i>Tibia</i> , and the <i>Fibula</i> ,	divided into four Tendons in the last Row of the Bones of the <i>Toes</i> . These <i>Muscles</i> bend the four least <i>Toes</i> of the <i>Foot</i> .	
	5th, 6th 7th, 8th	<i>Lumbricales,</i>	from the Tendons of the <i>Profundus</i> ,	in the lateral and inner Part of the first Bones of the four <i>Toes</i> . They form the Sole of the Foot.	
	9th, 10th 11th, 12th	<i>Interossei In- terni,</i>	from the Bones of the <i>Tar- sus</i> , and the Intervals of those of the <i>Metatarsus</i> .	along with the <i>Lumbricales</i> in the upper and inner Part of the Bones of the first Ar- ticulation of the four lesser <i>Toes</i> , which move towards the great <i>Toe</i> .	
	13th, 14th, 15th, 16th,	<i>Interossei Ex- terni,</i>	from the upper Part of the Interstices of the Bones of the Instep,	in the lateral and external Part of the first Bones of the <i>Toes</i> , which they remove from one another by Abduc- tion.	

Refer- ences	Number 4.	The great Toe has	Proceed	Inserted	Nerves, Vessels, &c.
26	1st	<i>Flexor Pro- prius,</i>	from the superior and poste- rior Part of the <i>Perone</i> ,	in the Bone of the first <i>Pha- lanx</i> , retaining the great <i>Toe</i> , which it bends.	
27	2d	<i>Extensor Pro- prius,</i>	from the fore and upper Part of the <i>Perone</i> , between the Bone and the <i>Tibia</i> ,	in the upper Part of the first Bone of the great <i>Toe</i> , which it extends.	
28	3d	<i>Thenar,</i>	from the lateral and internal Part of the Heel-bone, the navicular Bone, and <i>Ossa In- nominata</i> ,	in the upper Part of the se- cond Bone of the great <i>Toe</i> , which it pulls in.	
29	4th	<i>Antithenar,</i>	from the Bone of the <i>Meta- tarsus</i> that sustains the little <i>Toe</i> ,	in the inner Part of the first Joint of the great <i>Toe</i> , it pulls the great <i>Toe</i> outwards towards the other <i>Toes</i> .	
30	5th	<i>Abductor of the Index.</i>	from the inner Part of the first Bone of the great <i>Toe</i> ,	in the Bones of the second <i>Toe</i> , which it pulls towards the great one.	
	6th and last	<i>Hypothenar,</i>	from the outer Part of the Bone of the <i>Metatarsus</i> , which sustains the little <i>Toe</i> , for which it is calculated,	in the upper and outer Part of the Bones of the little <i>Toe</i> , which it draws off from the Rest.	

I'll conclude this Historically Mechanical Account of the *Muscles* of the Body, by an exact List of them, to help the Memory of young Pupils or Candidates.

M U S C L E S.

The Forehead has	2	The Ulna	12
The Occiput	2	The Radii	8
The Eye-lids	6	The Carpi, or Wrists	12
The Eyes	12	The Fingers	48
The Nose	7	Respiration	57
The external Ears	8	The Loins	6
The internal Ears	4	The Abdomen	10
The Lips	13	The Testicles	2
The Tongue	8	The Bladder	1
The Uvula	4	The Yard	4
The Larynx	14	The Anus	3
The Pharynx	7	The Thighs	30
The Os Hyoides	10	The Legs	22
The Lower-Jaw	12	The Feet	18
The Head	14	The Toes	44
The Neck	8		
The Shoulder-Blades	8	In all	434
The Arms or Shoul- der-Bones	18		

This done, I have nothing left, to render this Treatise of *Anatomy* a perfect one, but to finish by the *Angiology*; which is a Description of the Nerves, Arteries, and Veins of the inferior Extremity of the Body.

We have seen, already, seven, of the thirty Pair of Nerves, which march out from the Spinal Marrow, through the Holes of the *Vertebrae*, and those seven belong to the Neck; now we must discover those that belong to the Back, Loins, and *Os Sacrum*.

The twelve Pair of Nerves, which fall out from the *Vertebrae* of the Neck, extend no further than the Circumference of the *Thorax*; each of them divided into two Branches, the larger whereof are placed before, and the latter behind. The fore Branches are distributed into the internal and external intercostal Muscles, in each of the *Interstices* of the Ribs, send Shoots to the Muscles of the Breast, and to the oblique descending of the *Abdomen*.—The hinder Branches bend back, and are lost in the Muscles of the Back, and those which adhere to the *Vertebrae*.

Each of the five Pair which proceed from the *Vertebrae* of the Loins, is likewise divided into an *anterior*, and a *posterior* Branch; distributed partly in the Muscles of the Loins and the *Hypogastrium*, and partly in the Thigh.

Of the six Pair of the *Os Sacrum* (that Pair between it and the *Vertebrae* of the Loins included) none, but the first, marches out by its lateral Part, the other five make their Way before, and behind, because the Articulation of its lateral Parts, with the Bones of the *Iliac*, obstruct its Perforation in those Places; but by way of Recompence, it has ten *Foramina* before, and ten behind; and of these, five on each Side, which give an Egress to as many Nerves.

The *Spinal Marrow* terminates in a *Nerve*, which is distributed in the Skin between the Buttock and the *Anus*, and sends Branches to the Muscles of the Thighs, both on the right and left Side.

The biggest Branches of the three lowermost Pair of the Loins, and those of the four uppermost of the *Os Sacrum*, joining together in their Descent, form four Branches of Nerves, two of which are no lower than the Thighs; a third terminates in the Leg, and a fourth reaches to the Foot.

(33.) The first Pair of the Nerves of the *Thighs* is formed of the third and fourth Pair of the *Lumbares*, and passing near the lesser *Trachanter*, is distributed in the Skin and Muscles of the Thigh, and in some of those which move the Leg.—'Tis quite spent above the Knee.

(34.) The second, which springs from the same Source, and accompanies the crural Artery and Vein; is distributed to the anterior Muscle, the Skin of the Thigh, and the Circumference of the Knee, and sends out a Branch to accompany the *Saphena* to the inner Ankle, where it sinks.

(35) The third, which rises between the fourth and fifth *Vertebrae* of the Loins, and passes through the *Foramen* at the End of the *Pubes*, is dispersed in the Muscles of the upper Part of the Thigh, the *Pudenda*, and the *Triceps*, and lost in the Skin of the Groin.

(36) The fourth, is formed of the four superior Nerves of the *Os Sacrum*, which together form the *Cruralis*; which descends in an entire Body to the Ham, after having passed first near the Prominence of the *Os Ischium*.—At the *Ham* it divides again into two Branches, the outermost thereof runs from the Outside of the Foot to the Muscles of the *Pèrone*, and then turns back to the outer Ankle, where it terminates.—The inner Branch descends along the *Leg* to the Muscles of the Foot, and after spreading itself upon the inner Ankle, is spent upon the Sole of the Foot, and all the Toes, to each of which it dispenses two Branches.

To this Conclusion of all the Nerves of the Body, succeeds the Description of the Arteries, and Veins of the inferior Limbs.

We must have observed already that an *ARTERY* is a hollow fistulous Canal, appointed to receive the Blood from the Ventricles of the Heart, and distribute it to all Parts of the Body, for the Maintenance of Heat and Life, and the Conveyance of the necessary Nutrient.

The *Arteries* are ordinarily composed of three Coats, or Membranes; the first or outermost, nervous or tendinous, being a Thread of fine Blood-vessels, with Nerves for nourishing the other Coats. The second muscular, and made up of spiral Fibres; of which there are more, or fewer *Strata*, according to the Bigness of the Artery: These Fibres have a strong Elasticity, by which they contract themselves with Force, when the Power by which they have been stretched out, ceases.—The third, and inmost Coat, is a fine, dense, transparent Membrane, which keeps the Blood within its Channels, which otherwise, upon the Dilatation of an *Artery*, would easily separate the spiral Fibres from one another.—As the *Arteries* grow smaller, these Coats grow thinner.

All the *Arteries* are conical, *i. e.* begin with a Trunk, and growing less and narrower, ends in Branches so minute, that they escape the Sight, unless assisted with Microscopes; by which in the Tails of Tadpoles, and very small Eels, the Extremities of the *Arteries* seem, by the swift, uninterrupted Course of the Blood, to be insculated or continued to the Originations of the Veins; though by the Transparency of those Vessels, the actual Continuation be not visible.

The Coats of the *Arteries* are of a very dense, close, Contexture, by which Means the Blood not being visible through them, they generally appear white. Add, that the Blood proceeding from a greater Capacity to a less, is thereby somewhat obstructed in its Passage; but being forced on by the Motion of the Heart, distends the Coats, and thereby occasions a *saliant* Motion, called the *Pulse*.—By this Thickness and Whiteness of the *Arteries*, with the Pulsation observed therein, *Arteries* are distinguished from *Veins*.

The *Pulse* of the *Arteries*, as that of the Heart, consists of two reciprocal Motions, a *Systole*, or Contraction, and a *Diastole*, or Dilatation; but they keep opposite Times; the *Systole* of the one answering to the *Diastole* of the other.

All the *Arteries* of the Body, we have observed, arise in two large Trunks from the two Ventricles of the Heart, *viz.* the *Pulmonar Artery* from the right Ventricle, and the *Aorta* from the Left.

The *AORTA*, or *great Artery*, after it leaves the Heart,

Heart, divides itself into two large Trunks, called the *ascending*, or upper; or *descending*, or lower Trunks.

The descending Trunk (for we have seen already the ascending one) or *Aorta descendens*, carries the Blood to the Trunk and the lower Parts of the Body.

Out of this arise the *Bronchial*, *Intercostal*, *Celiac*, *Phrenic*, *Mesenteric*, *Emulgent*, *Spermatic*, *Iliac*, *Umbilical*, *Epigastric*, *Hypogastric*, *Crural*, &c. with their several Ramifications.

(37) The ARTERIA ILIACA, which is one of those great Branches of the *Aorta descendens*, changes its Name at its Egress out of the *Abdomen* into that of *Arteria Cruralis*, upon its Arrival into the Thigh, where it produces three or four Branches, which are spent upon the Skin, and Muscles of the upper and Fore-part of the Thigh, but at the Distance of three or four Fingers Breadth, under the Groin, it produces,

(38) 1. The MUSCULARIS INTERNA (thus called from its Situation in the inner Muscles of the Thigh) which sends out four Sprigs, one to the *Abductores* of the Thigh, and to the *Triceps*, *Biceps*, and *Semi-nervosus*, and the *Semi-membranosus*; one to the upper Part of the *Triceps*; the two others to the Body of the *Triceps*, and to the *Gracilis*.—After this, the Trunk of the same Artery divides into three Branches; the first of which passing by the End of the third of the *Tricipites*, is lost in the *Semi-membranosus*; the second passing under the Thigh-bone, is spent in the *Vastus Externus*; and the third moving downwards, sends out Branches at the End of the third of the *Tricipites*, and is lost in the *Semi-nervosus*, and the Head of the *Biceps*.

(39) The MUSCULARIS EXTERNA is the second which runs to the outer Part of the Thigh, and passing under the *Sartorius* and the *Gracilis Rectus*, sends out Branches at the End of the *Iliacus*, to the *Vastus Externus*, the *Cruralis*, and the *Membranosus*.

(40) The third springs from the *Cruralis*, detaches Branches to the *Cruralis*, and *Vastus Externus*, and is lost in the Membranes and Fat of the Thigh.

(41) The *Cruralis* in its farther Progress to the lower Limbs, furnishes the adjacent Muscles with several Branches, passes near the Tendons of the *Triceps*, and at its Arrival at the Ham, sends out little Branches, to the Tail of the Muscles of the hinder Part of the Thigh, which are lost in the Fat.—Below the Ham it produces the two *Popliteæ*, which embrace the Knee, one on the Inside, and the other on the Outside; and a little lower the *Suralis*, which direct their Course to the *Gemelli*; the *Soleus*, the *Pantaris*, and the *Popliteus*; and encompasses the Bones of the Leg by several Branches, that terminate there.

(42) Here the *Cruralis Anterior*, and *Posterior* begin. The former runs across the Membrane that joins the Bones of the Leg, and continuing its Course, dispenses Branches to the *Tibialis Externus*, and *Extensor* of the Toes.

(43) The *Cruralis Posterior*, which is the largest of the two, divides itself into the *Primus Posticus*, which dispenses Branches to the *Soleus*, *Peroneus Posterior*, and the Bender of the great Toe, ascending by the outer Angle, goes to be lost in the upper Part of the Foot; and the *Secundus Posticus*, which in its Descent sends out Sprigs to the *Soleus*, the Benders of the Toes, and the *Crureus Posticus*; and then passing through the Cavity of the *Fibula*, is divided into two Branches, one that passes under the *Tbenar* to the great Toes, and another between the *Brevis*, and the *Hypothenar*, under the Sole of the Foot, and is spent upon the four other Toes.

We'll begin the Demonstration of the *Veins* of the lower Limbs, as we have done that of the *Arteries*, by some general Observations upon the *Veins*.

The *Veins* are Vessels or Canals which receive the Blood from the divers Parts of the Body, to which the *Arteries* had convey'd it from the Heart, and carry it back to the Heart again.

The *Veins* are only a Continuation of the capillary Arteries, reflected back again towards the Heart.

In their Progress uniting their Channels as they approach the Heart, they at last form three large Veins, or Trunks, viz. the *Vena Cava descendens*, which brings the Blood back from all the Parts above the Heart.—The *Ascendens*, which brings the Blood back from all the Parts below the Heart.—And the *Porta*, which carries the Blood to the Liver.

The *Anastomosis* or Inosculation of the *Veins* and *Arteries*, was first seen by the Microscope, in the Feet, Tail, &c. of Frogs, and other amphibious Animals, by *Liveboek*; but has since been observed in other Animals, particularly the *Omentum* of a Cat, by Mr. *Cowper*.

The Coats of the *Veins* are four, the same with those of the *Arteries*; only the muscular Coat is thin in all the *Veins*, as it is in the capillary Arteries; the Pressure of the Blood against the Sides of the *Veins*, being less than against the Sides of the *Arteries*, because the Force of the Heart is much broke in the Capillaries.

In the *Veins* there is no Pulse, because the Blood is thrown into them with a continual Stream, and because it moves from a narrow Channel into a wider; but they have a peristaltick Motion, which depends on their muscular Coat.

The capillary *Veins* unite with one another, as has been said of the capillary Arteries, only their Course is directly opposite; for instead of a Trunk distributed into Branches, and Capillaries, a *Vein* is a Trunk, formed out of a Concourse of Capillaries.

In all the *Veins*, which are perpendicular to the Horizon, excepting those of the *Uterus*, and the *Porta*, there are small Membranes or *Valves*; sometimes there is only one, sometimes two, and sometimes three placed together, like so many half Thimbles stuck to the Sides of the *Veins*, with their Mouth towards the Heart.

These, in the Motion of the Blood towards the Heart, are pressed close to the Sides of the *Vein*; but shut the *Veins* against any Reflux of the Blood that way from the Heart, and thereby sustain the Weight thereof in the great Trunks.

The *Veins* are distinguished with Respect to their Situation, into *superior* and *inferior*, *descending*, and *ascending*; *right* as the *Mesenterick*, and *left* as the *Splenic* Branch; *internal* as the *Basilica*, and *external* as the *Humeral*, &c.

One of the Principal among the ascending *Veins*, is the *Cruralis*, formed by six Branches of other *Veins*, inserted in that Part; the first whereof is,

(45) The ISCHIADICA MAJOR, which proceeds from ten Sprigs of Veins, two whereof come from each Toe, and form a Branch which is joined by another that comes from the *Fibula*, and the Heel-bone, and both ascending by the Muscles of the Calf of the Leg, unload, by a joint Stream, in the *Cruralis*.

(46) The SURALIS is the second, formed by almost all the Veins that creep along the Foot, and by those that come from the Calf of the Leg.

(47) The third is the POPLITEA, produced by the Sprigs of the Heel, and Part of those of the Neck of the Foot, from whence it ascends, passes by the Ham, and terminates in the *Cruralis*.

(48) The MUSCULAR is the fourth, and comprehends two Branches, viz. the *Muscular Externa*, which proceeds from the external Muscles of the Thigh, and the *Interna* from the internal Muscles.—These two Branches enter the *Cruralis* opposite to one another.

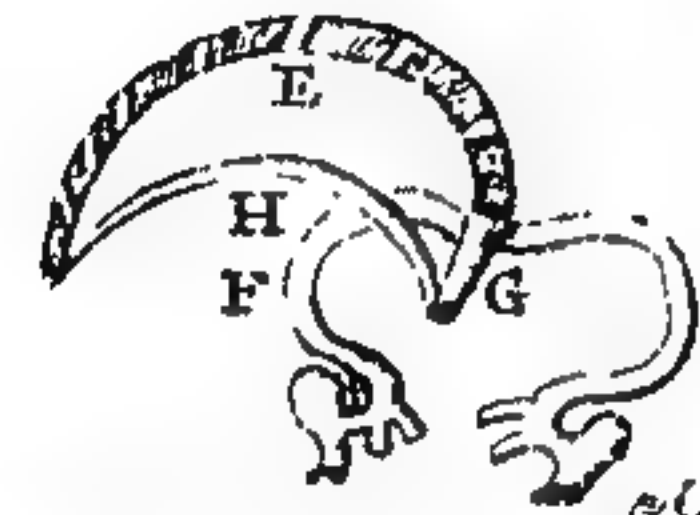
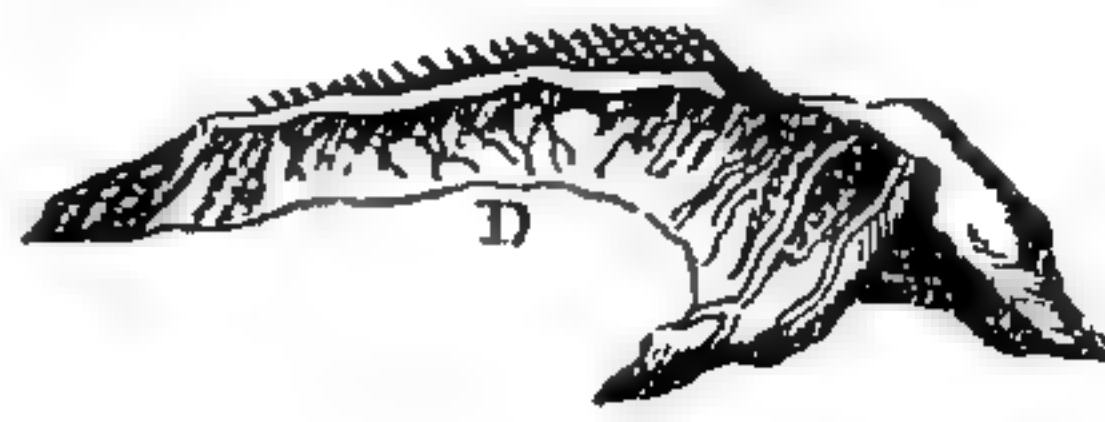
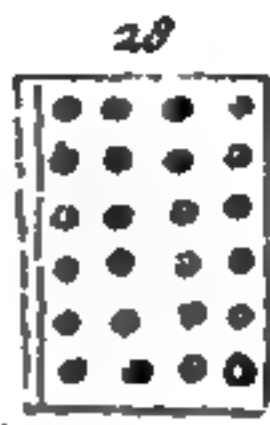
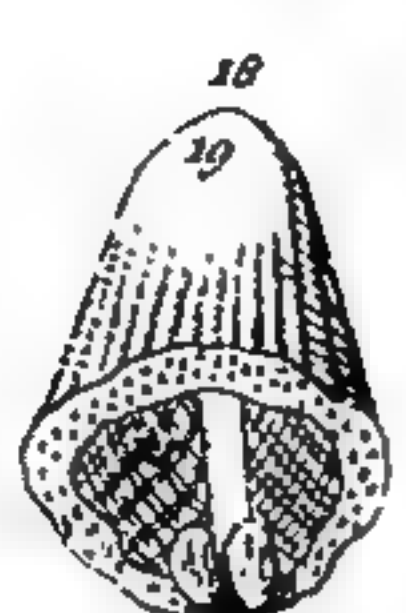
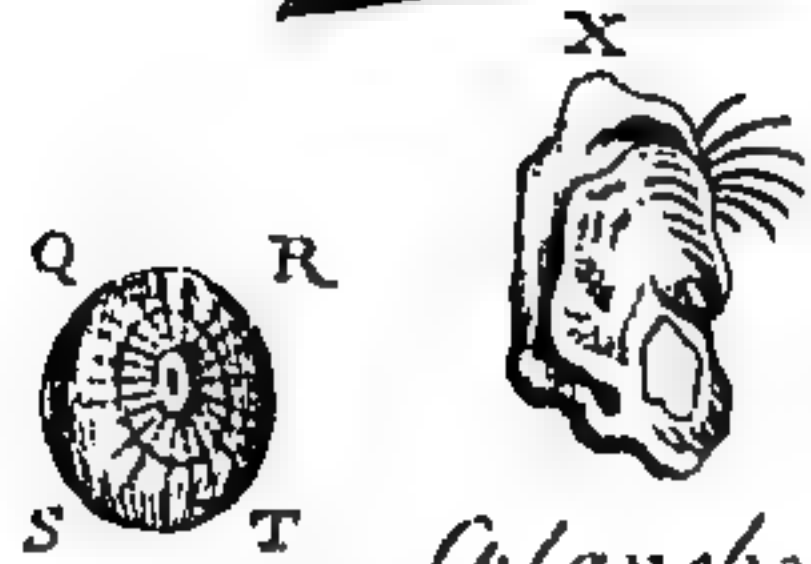
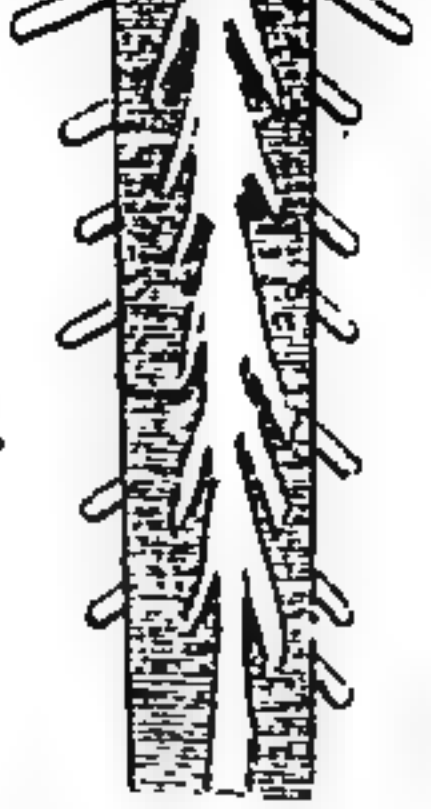
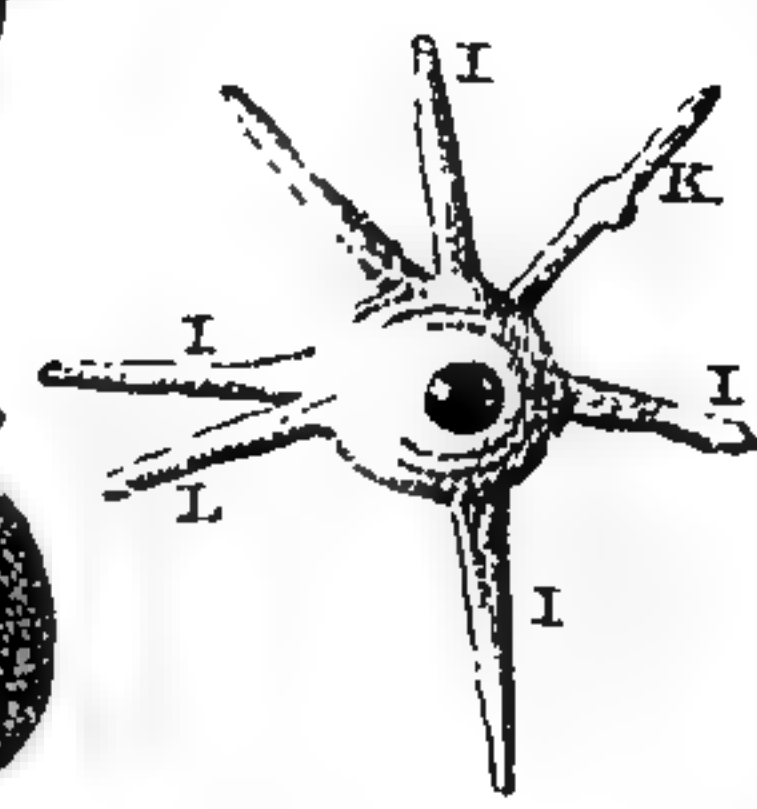
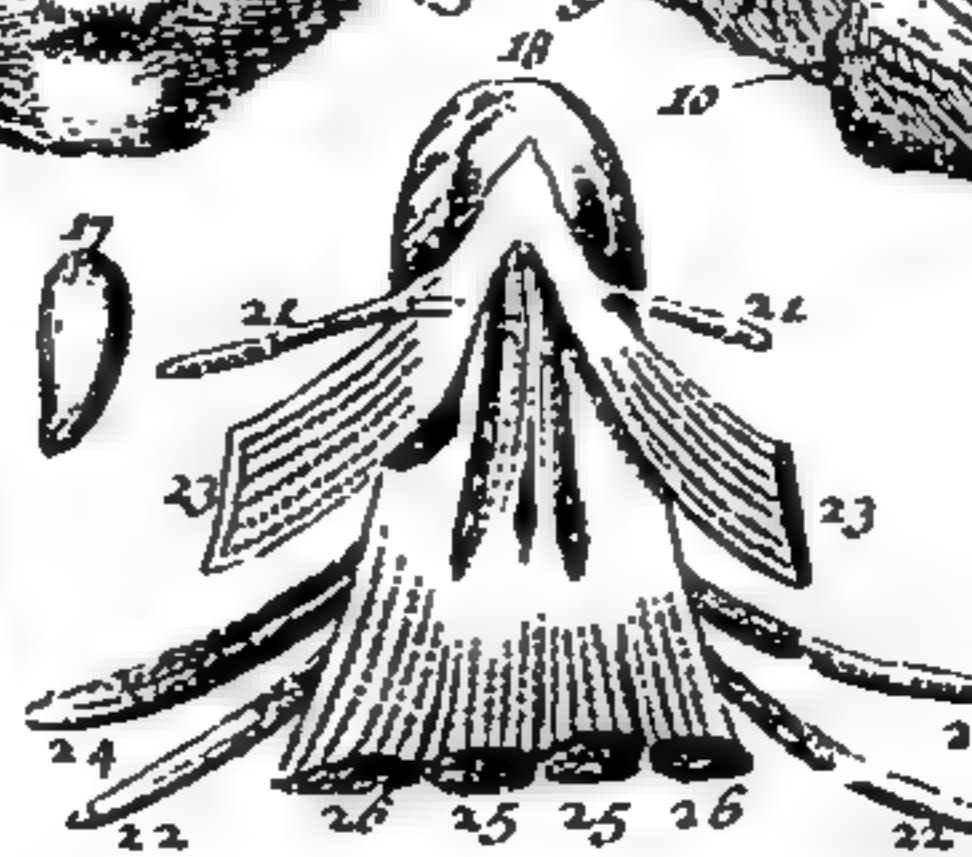
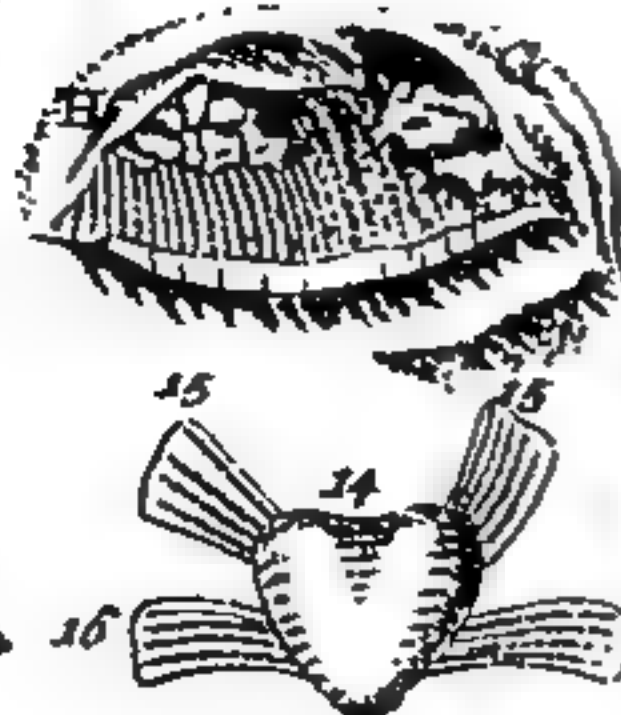
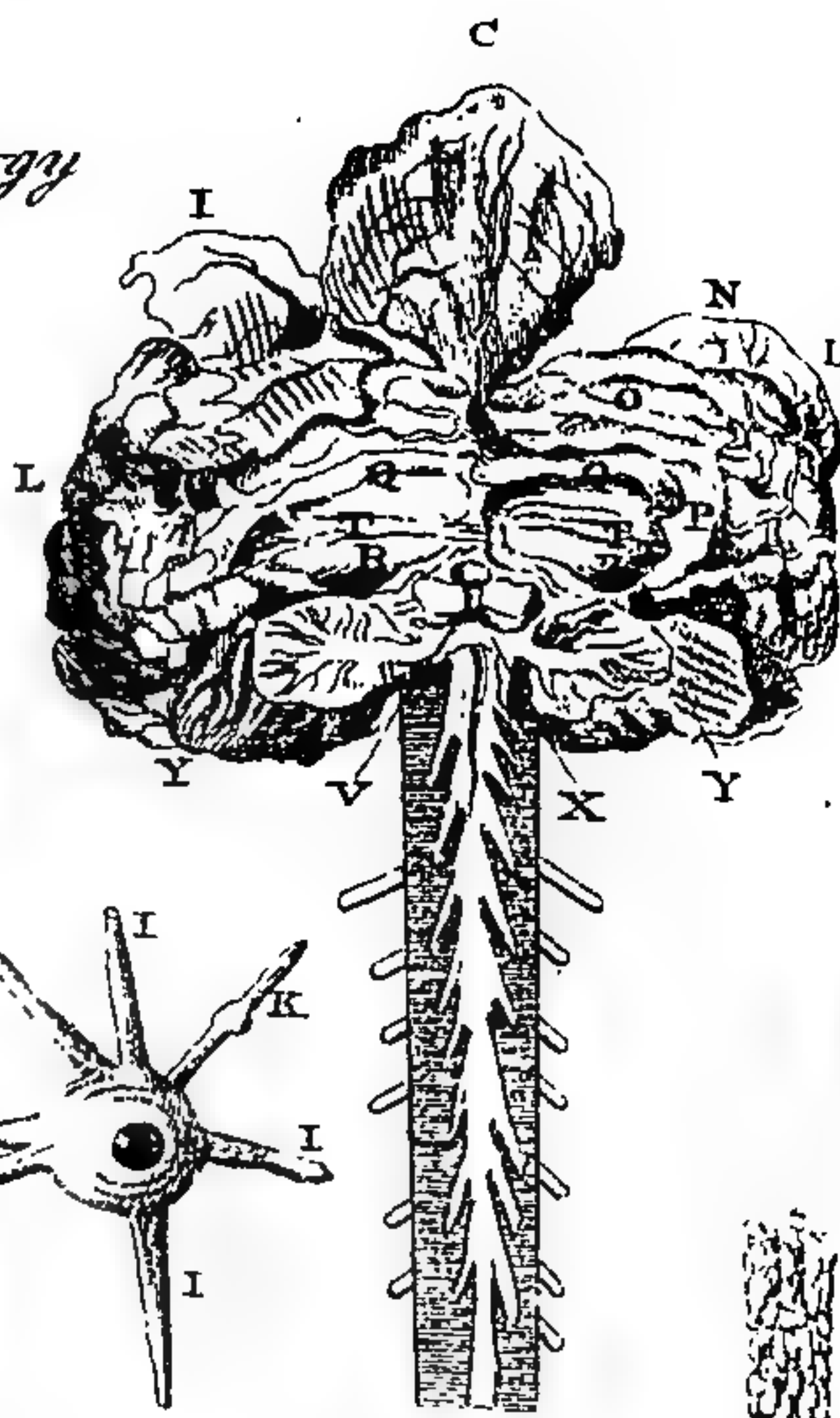
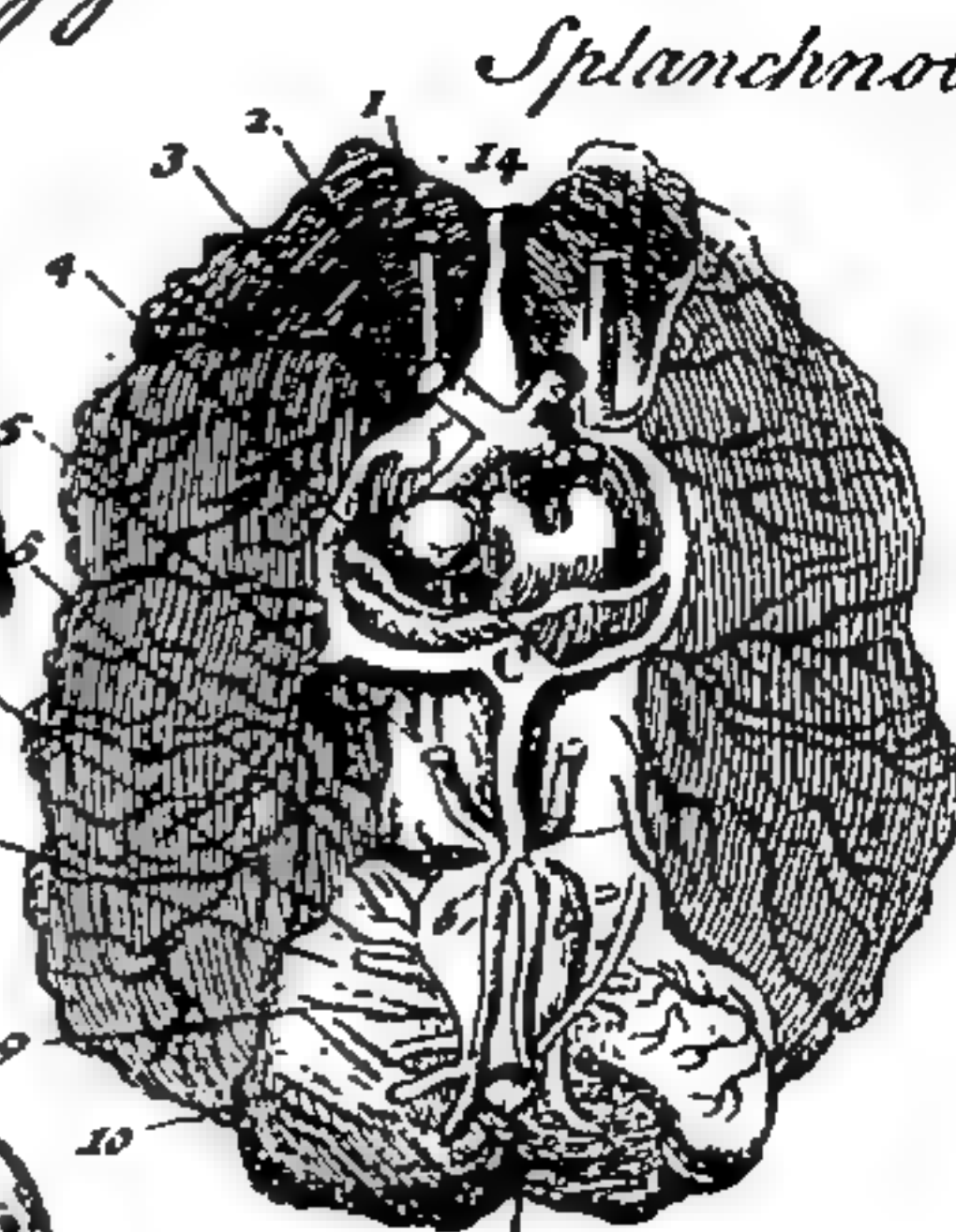
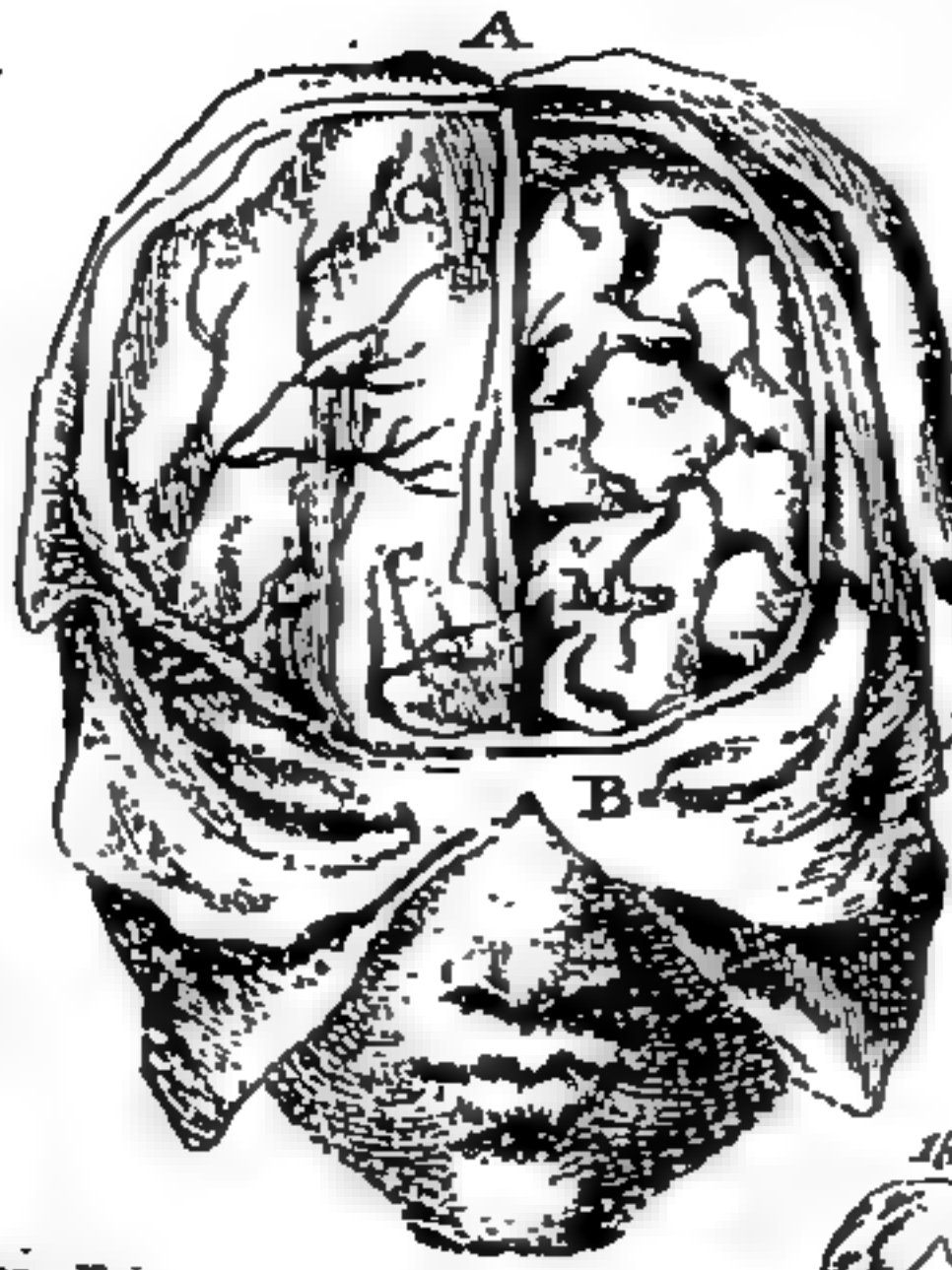
(49) The ISCHIADICA MINOR, which is the fifth and the least of all, is produced by several Ramifications from the Skin, and the Muscles that surround the Jointing of the Thigh.

(50) The longest and biggest of all the six, is the *Saphena*, which begins at some Branches from the

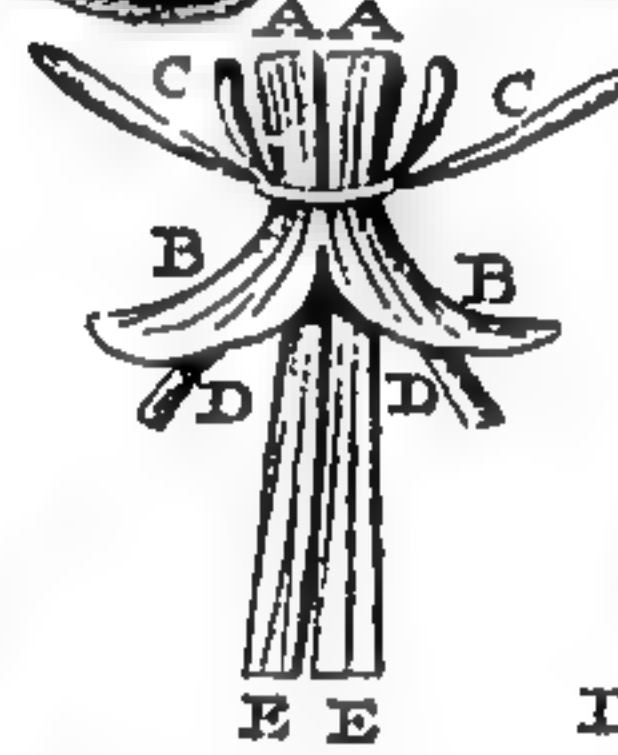
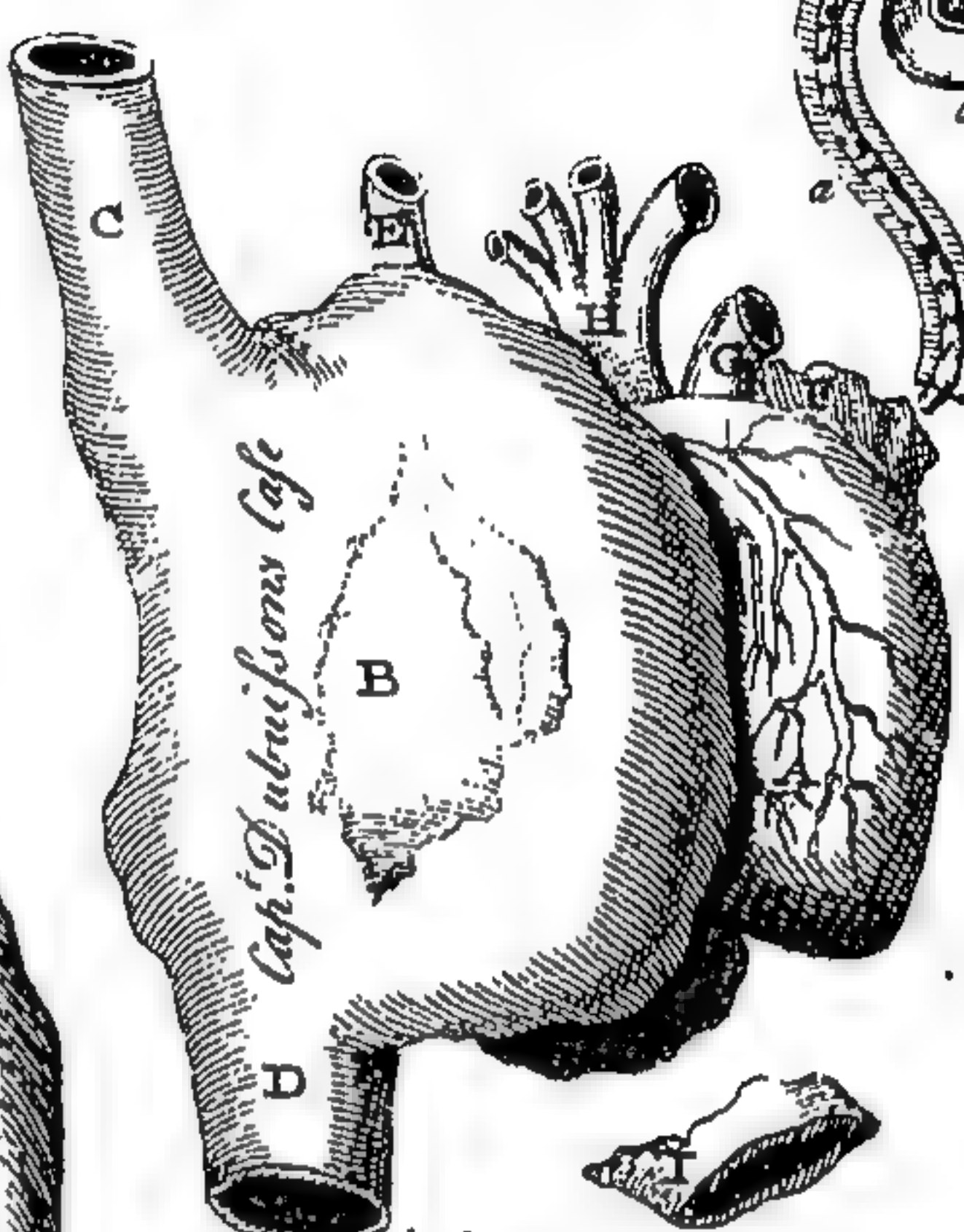
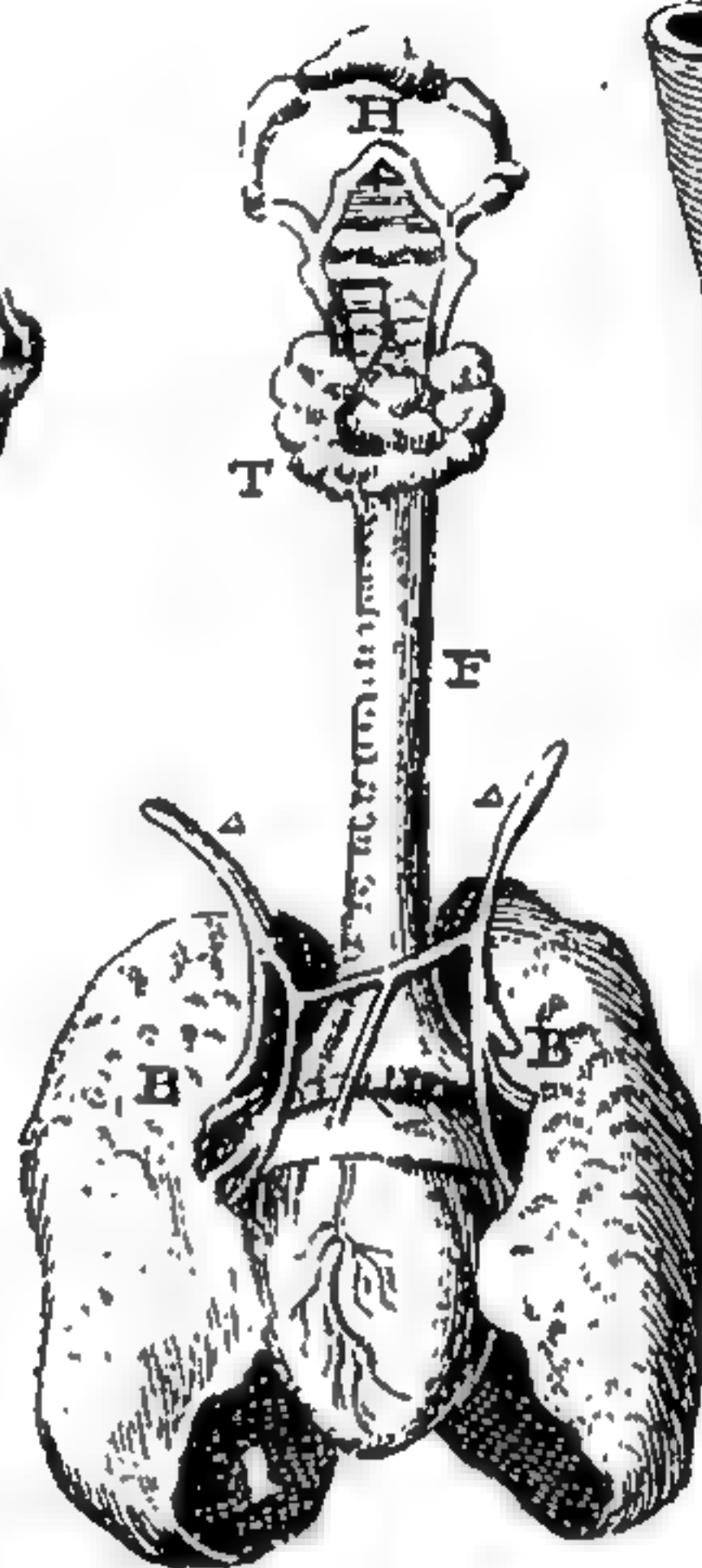
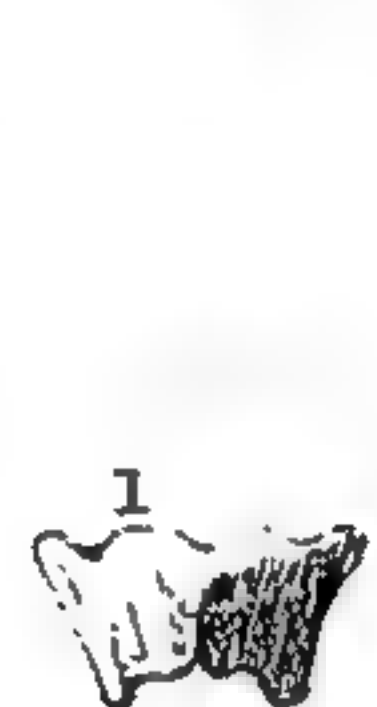
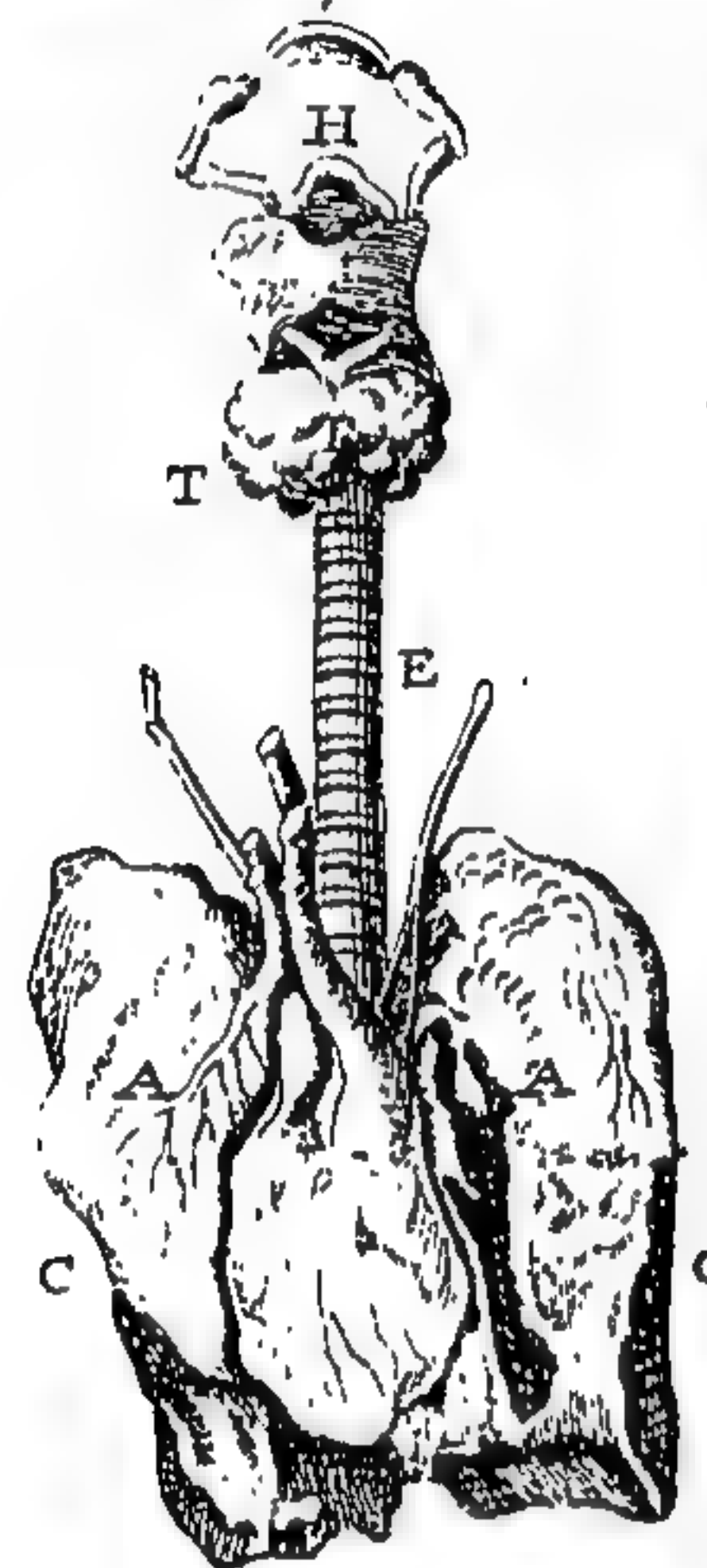
Myology

Sarcology

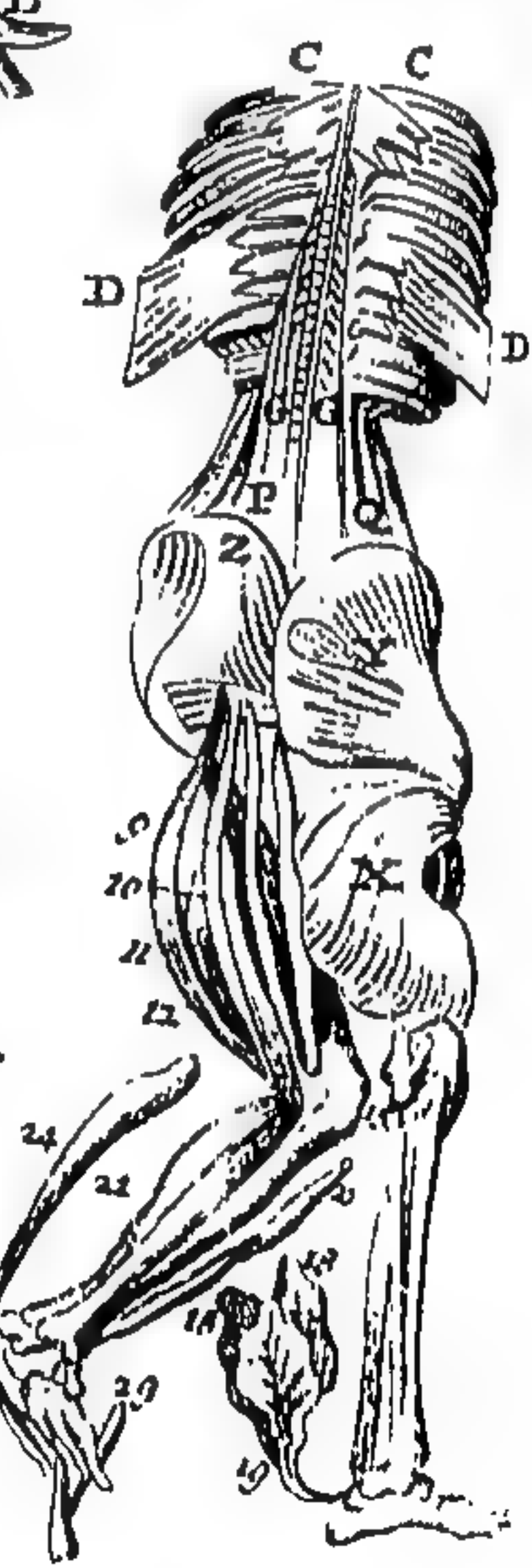
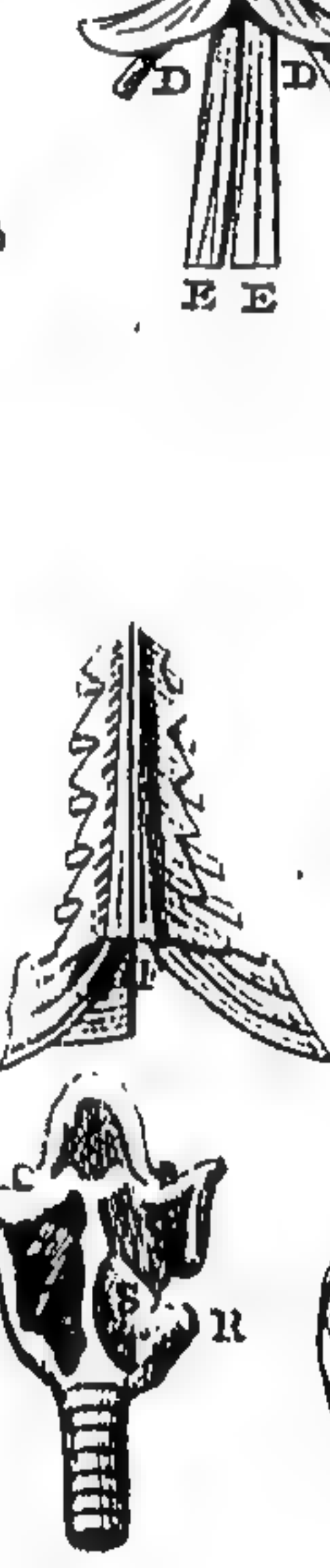
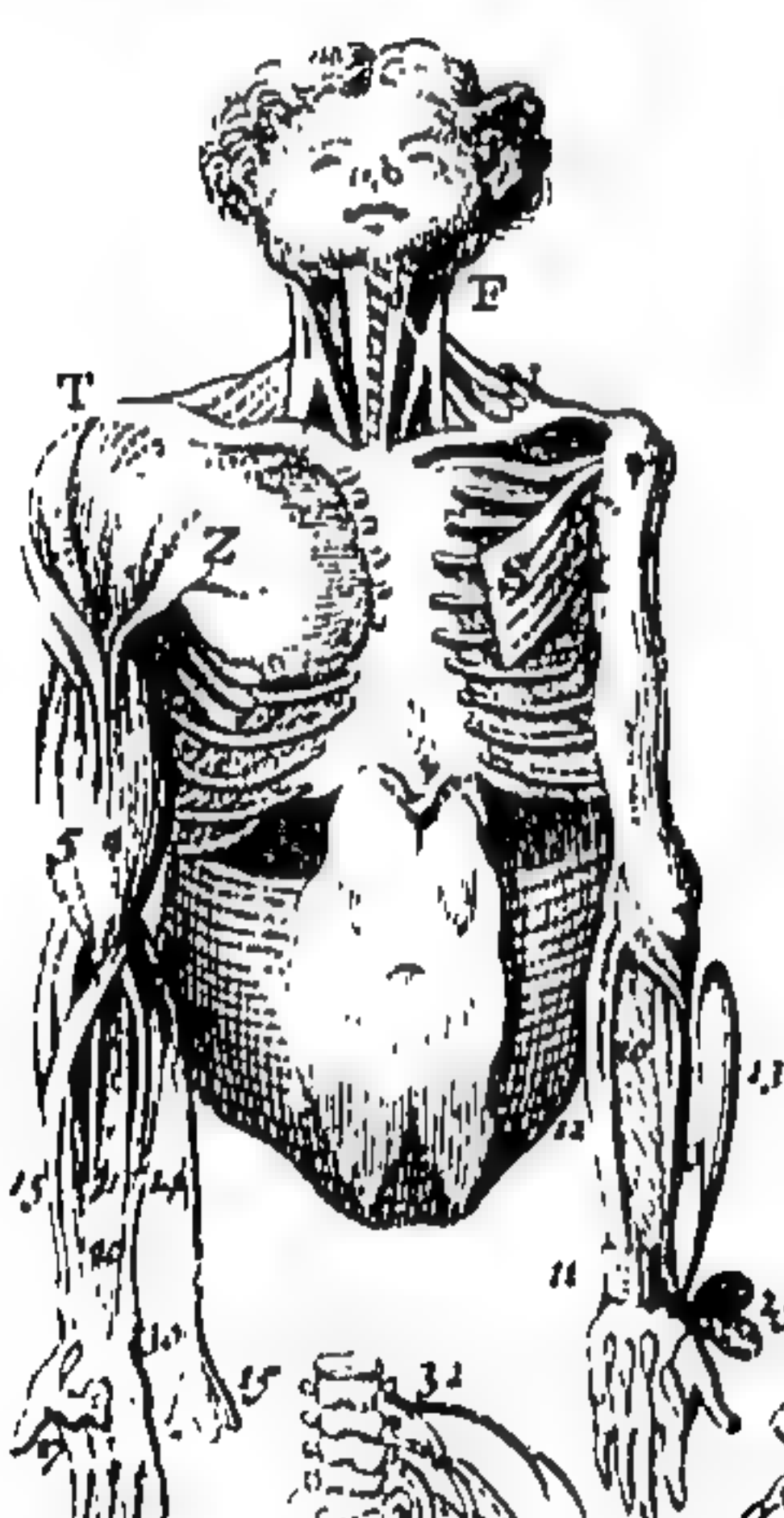
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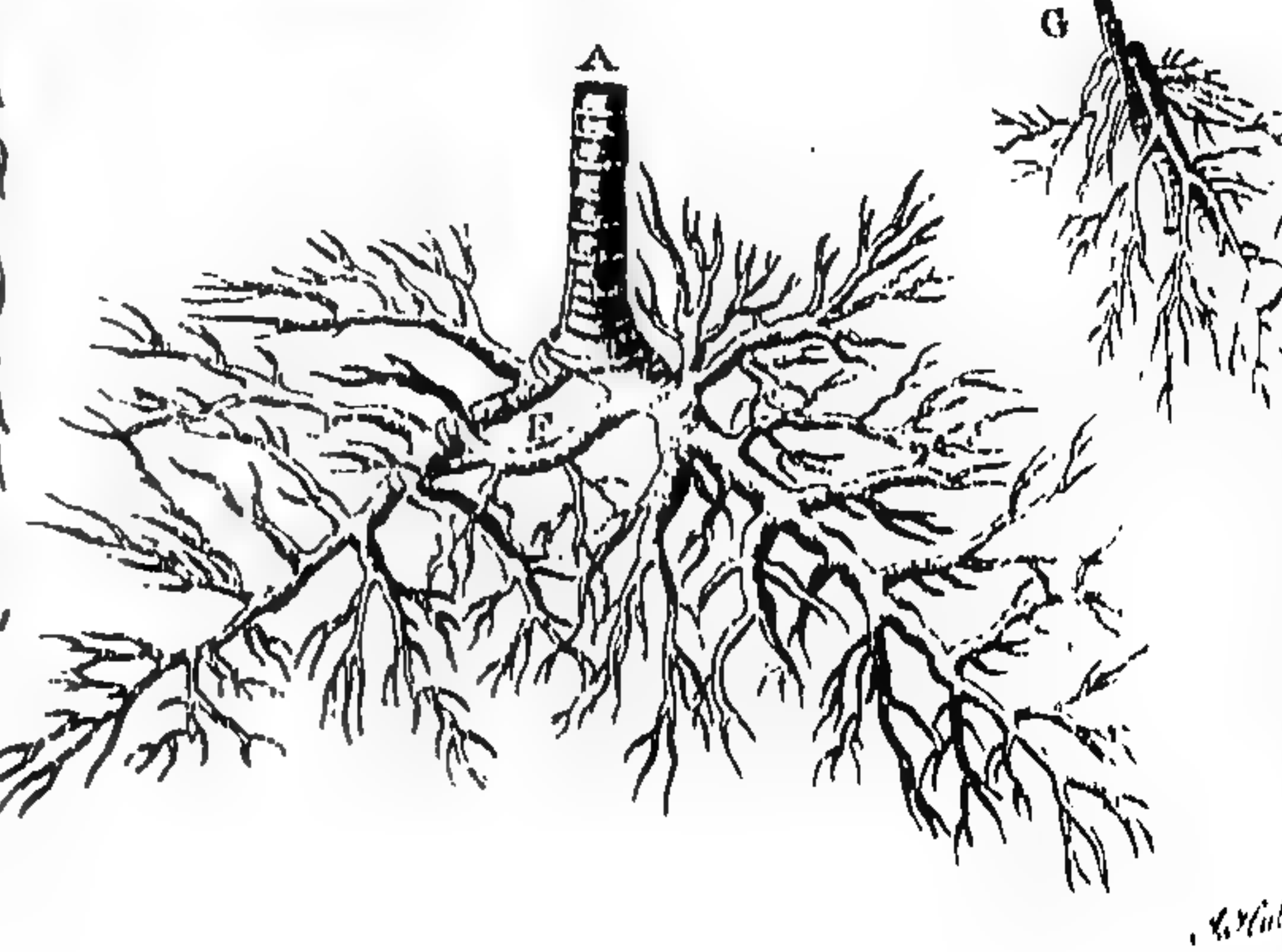
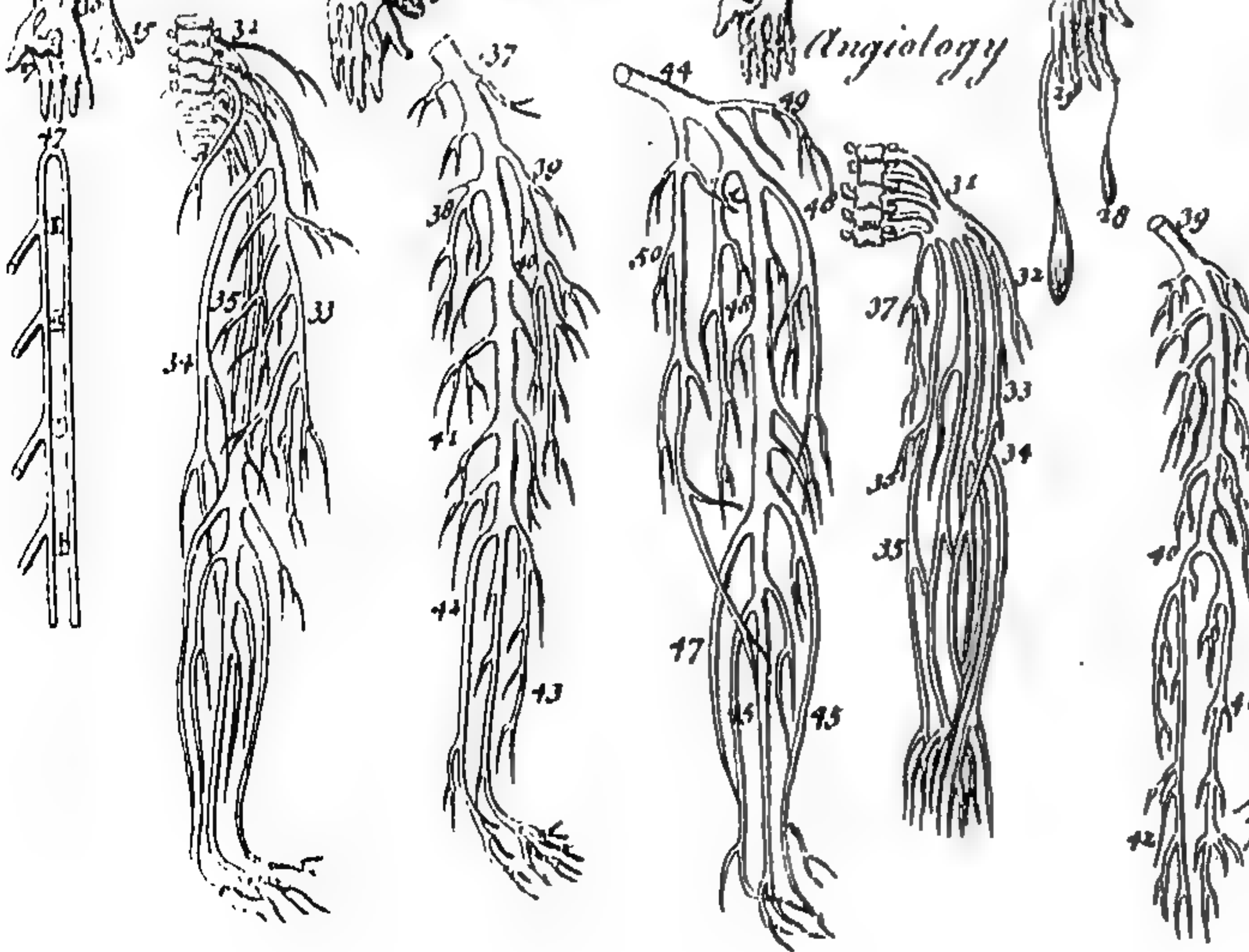
Splanchnology



Myology



Angiology



the great Toe, and by ascending by the inner Ankle along the Leg, and the inner Part of the Thigh, between the Skin and the fleshy Membrane, terminates in the *Cruralis*, which mounting upwards, and having past the Groin, empties it self in the *Iliaca*, the *Iliaca* into the *Cava*, and the *Cava* into the right Ventricle of the Heart.

ANGIOLOGY treats likewise of the lymphatick Vessels, which are small Pipes, consisting of a very thin Coat, full of *Valves*, which open like those of the *Veins* towards the Heart, and shut upon the Reverse.—They have no common Cistern, for some of them unload in the Thoracick Duct, and others immediately in the *Veins*—Some proceed from the *Viscera*, and others from the Glands dispersed all over the Body.—Those that spring from the Conglobate Glands, convey their Lymph to the *Veins*; and those from the Conglomerate disembogue in particular Cavities, as the Eyes, Mouth, *Duodenum*, &c.

The Number of these Vessels is infinite, but they cannot be all discerned with the Eyes.—Their Lymph proceeds from the Serosities of the Blood filtrated in the Glands. Commonly it is clear and transparent, but it changes its Colour in Proportion to the Tinctures it receives from the *Chyle*, the *Bile*, and the other Humours contained in the Blood.—Of itself it is insipid; but sometimes it has been found, acid, bitter, or brackish.—It fixes and congeals by the Mixture of Humours, and the Dissolution of Salts, as well as the *Serum* of the Blood.

I don't believe I have left any Part of the human Body pass unobserved, except the *Nails*, which are hard, round, white and transparent Bodies, seated at the Ends of the Fingers.

The *NAILS* are nothing more but the Covers, or Sheaths of the *Papillæ Pyramidales* of the Skin, on the Extremities of the Fingers, and Toes, which dry, harden, and lie upon one another.

Their Use is to strengthen, and defend the End of the Fingers, in handling any hard and rugged Bodies; that part being extremely sensible, by Reason of the great Number of Nerves, which terminate here, for the Sensation of Feeling.

The *Nails* are formed, and grow after the same Manner as the rest of the Body; their Nourishment they receive from their Roots, as is easily observable, from the white Specks sometimes seen on them, and which constantly recede from the Root.

The *Romans* were very curious in cutting their *Nails*, and had it done by Artists, who made an Employment of it.

The *Chinese* Doctors, and *Literati*, pique themselves on the excessive Length of their *Nails*.—Father *le Compte* says, some of them wear *Nails* near as long as their Fingers.

According to *Malpighi*, the *HAIRS* (wherewith we'll conclude this Course of *Anatomy*) have Roots that resemble those of the bulbous Heads of Tulips; and these Roots are nourished by Blood-vessels, accompanied with Nerves; insomuch that the Hairs grow, and sometimes become so big, that they are carnous and sensible of Pain, and bleed plentifully when they are cut; pursuant to the Remarks made upon the Disease called *Plica*.

The *Hairs* ordinarily appear round and cylindrical, but the Microscope also discovers triangular, and square ones; which Diversity of Figures arises from that of the Pores, to which the *Hairs* always accommodate themselves. Their Length depends on the Quantity of the proper Humour to feed them, and their Colour on the Quantity of that Humour, whence at different Stages of Life the Colour usually differs.

The antient Writers of *ANATOMY*, *Hippocrates*, *Democritus*, *Aristotle*, *Galen*, and others, look upon this as the most important Part of Physick, and that without which, the Uses of the Parts of an human Fabrick, and consequently the Causes of Diseases incident thereto, could no way be discovered. And yet this Art, useful as it is, was intirely discontinued for several Ages; till in the sixteenth Century, it began to flourish afresh.—The Dissection of an human Body was looked upon as Sacrilege before that Time; and we have seen a Consultation which the Emperor *Charles V.* appointed to be held by the Divines of *Salamanca*, in order to be satisfied whether or no it were lawful in Point of Conscience, to dissect a dead Carcase.—We may add, that to this Day the Use of *Anatomy*, and Skeletons is forbid in *Moscovy*; the first as inhuman, the latter as subservient to Witchcraft; and *Olearius* assures us, that one *Quirin*, a German Chirurgeon, being found with a Skeleton, hardly escaped with his Life; and the Skeleton, after being solemnly dragged about the Streets, was burnt in Form.

Vesalius a *Flemish* Physician, who died in 1564, was the first who set *Anatomy* on any tolerable Footing; he was seconded by *Carpus*, *Sylvius*, *Fernelius*, *Fallopian*, *Eastathius*, *Fabricius*, *Pareus*, *Bacchinus*, *Hoffman*, *Riolanus*, &c.

These were succeeded by others, to whom some of the finest Discoveries in *Anatomy* are owing.—*Assellius* in the Year 1622, discovered the lacteal Veins; and in 1628, the immortal *Harvey* published his admirable Discovery of the Circulation of the Blood.—*Pecket* discovered the Reservoir of the Chyle, and the Thoracick Duct, in 1651.—*Rudbecks*, a *Swede*, and *Bartholine*, a *Dane*, found out the Lymphatic Vessels, in 1650 and 1651.—*Wharton* in 1655, discovered the lower *Salival* Duct; and *Steno*, the upper *Salival* Ducts, those of the Palate, the Nostrils, and Eyes, in 1661. *Wirtfungus*, in 1642, discovered the Pancreatick Duct.—*Willis*, who came after him, published an *Anatomy* of the Brain and Nerves, in a Manner much more exact than had been done before him; yet he had omitted some considerable Things, which were afterwards observed by *Vieussens*.—*Glisson* treated particularly of the Liver; *Wharton*, of the Glands; *Havers* of the Bones; *Graaf*, of the Pancreatick Juice, and the Parts of Generation; *Lower*, of the Motion of the Heart; *Thruston* of Respiration; *Peyer* of the Glands of the Intestines; *Brown*, of the Muscles; *Drelincourt*, of the Conception of the Ova in Women, the *Placenta*, and the Membranes of the *Fœtus*.

Malpighi, who died in 1694, is one of those to whom *Anatomy* owes the most: He made a great Number of Discoveries in the *Lungs*, *Brain*, *Liver*, *Spleen*, *Glands*, and *Lymphaticks*, by the Help of the Microscope, &c.—*Ruythe*, who died in 1727, has let great Light into many of the finer and more intricate Parts of the human Frame, particularly the Glands; by Means of his Injections.

Manget, and *le Clerc*, two Physicians of *Geneva*, have giving us *Bibliotheca Anatomica*, containing all the new Discoveries that have been made in this Art.—The best Systems of the Art, as it now stands, are those of the *Verheyen*, *Drake*, *Keil*, *Keister*, *Winslow*, *Robault*, *Purchot*, &c.

ANATOMY is sometimes used to denote the Subject to be anatomized. Thus (by 32 H. VIII. cap. 42.) the Company of Barbers and Surgeons may have and take yearly, four Persons condemned, adjudged, and put to Death for Felony, for Anatomies; and to make Incision of the same dead Bodies.

ANGELS.

ANGEL is a created Spirit, perfect in his Kind.

The Word is not properly a Denomination of Nature, but of Office, denoting as much as *Nuntius*, Messenger; since the principal Office of *Angels*, is to be God's Messengers, and execute his divine Orders; as when the *Angel Gabriel*, *Luke* i. 26. was sent to the Virgin *Mary* to carry her the News of the Incarnation of the Word.—*St. Paul*, *Heb.* i. 14. calls *Angels* (for the same Reason) *ministering Spirits*. The same Name is given to Priests, *Malachi* ii. 7. because Priests are appointed as God's visible Messengers to us, to inform us of every thing relating to our eternal Felicity.—The *Divine Percursor*, *St. John Baptist*, is also called an *Angel*, by *St. Matthew* xi. 10. because sent to prepare *Christ's Ways*.—*Jesus Christ* himself, according to the *Septuagint*, is called in *Isaiah* ix. 6. the *Angel of the mighty Council*; which Denomination belongs to *Christ* in several other Places of Scripture; though, according to *Tertulian*, *de Carne Christi*, c. 4. it speaks his Office, not his Nature.

Angel is defined a created Spirit, not a created Body, or an extended Substance, because a corporal Substance cannot see God, and the *Angels*, *Matth.* xviii. 10. see the Face of God. Besides, they occupy no Place, or have no Ubiquity, as it appears from the *Legion of Evil Spirits*, which *Christ* expelled from the *Energumenus*, *Mark* v. 13.

Angel is also called a *created Spirit*, by Distinction, from God, who is likewise a Spirit, but uncreated, being himself his own *Esse*, or *Being*; or *Ens*, by his proper Essence; while an *Angel* has his *Ens*, or Being, only by *Participation*, and is but like a Shadow of a spiritual Being, when compared to God.—Tho' an *Angel* is a perfect Creature in his Kind, *i. e.* he is created to subsist by himself, and has not been created, like the rational Soul, to form, in conjunction with a Body, an entire Nature; since the angelical Nature is perfect, and can subsist of itself, without any Mixture or Composition.

This Definition of *Angels*, is not agreeable to the *Epicurean* System, which knows nothing in the whole Creation, but corporal Substances; nor to that of the *Sadducees*, who deny'd the Resurrection, and the Existence of Spirits, or spiritual Substances, *Acts* xxiii. 8.—Even some of the *Fathers* of the primitive Church, who admitted the Existence of *Angels*, thought they could not exist, without their spiritual Substance being united to a corporal one, formed of the Co-adunation of the most subtle Particles of the Air and Fire, which Doctrine they had learned from the *Platonicians*, and which they attempted to defend and authorize by this Passage of *Genesis* vi. 2. when the *Angels of God* saw the Daughters of *Men* that they were fair, they took them Wives of all which they chose: And whereas pure Spirits could not take Wives, those *Fathers* concluded, that *Angels* were united to a corporal Substance in the same Manner our Soul is united to our Body; with this Difference only, theirs was formed of a finer Clay; which Error proceeded from the imperfect Notion they had in those Days of the Nature of a spiritual Substance. Tho' the Opinion of spiritual Substances existing of themselves, and without an Union with corporal ones, is not of a new Date, or of a Christian Invention.

Aristotle, *Lib. IV. Metaph.* cap. 7, 8. long before the Foundation of the Christian Church, had asserted, not only that God was an immaterial Substance, of an Order quite superior and different from a corporal one, but there existed also, other Substances, called *Intelligences*, or thinking Substances, free from all Commerce and Union with *Matter*, such as were those he supposed to give the first Motion to the Planets and other celestial Bodies.

However the Passage of *Genesis* quoted by the *Fathers* to support the Doctrine of the *Platonicians*, cannot be understood of *Angels*, as properly *Angels*, but of the Righteous of those Days, *viz.* the Posterity of *Seth*, who, in Consideration of their Father's Piety are called the *Sons of God*, or as some read it, the *Angels of God*, and who took Wives among the Daughters of *Cain*, called in this Place the Daughters of *Men*.

Another strong Argument used against the *Angels* existing without the Concurrence or Conjunction of a corporal Substance, is taken from the fifth Session of the second Council of *Nice*, where the Opinion of *John Bishop of Thessalonica*, that *Angels were to be painted*, was approved, and consequently the Inferences which *John of Thessalonica* draw'd from his Premises, that the *Angels* were corporal and not spiritual; since Bodies only, not Spirits, could be drawn by a Pencil.

To which it may be answered, that that Part of the Opinion of *John of Thessalonica*, as to painting *Angels*, was approved by the Council, but not the other, whereby he is pretended to have proved, that the Substance of *Angels* was material.

Denis the Areopagite, divides the nine Orders of spiritual *Intelligences*, called *Angels*, into three Hierarchies, which Division *Estius*, in 2 *Lib. Magistr. Sentent. Distinct.* 23. pretends to be founded on the Scripture, *viz.*

The first HIERARCHY to consist of the *Seraphims*, *Cherubims* and *Thrones*.

The second, of the Denominations, *Virtues*, and *Powers*.

And the third to comprehend the *Principalities*, *Archangels* and *Angels*.

The SERAPHIMS make that Class of *Angels* supposed to be the most inflamed with divine Love, by their nearer and more immediate Attendance on the Throne; and communicate their Heat to the inferior and remoter Orders. Penetrated and inflamed with the immediate Irradiations of an eternal and divinely consuming Fire, they reflect its immensely radiant Beams, which are the Source and sacred Origin of an eternal Beatitude on the other Inhabitants of the celestial Mansions.

CHERUBIMS are celestial Spirits placed next in Order to the *Seraphim*, and also inflamed with a greater Degree of divine Love, with regard to the inferior Orders; and thus down to the *Angels* who are the last Order of the third Hierarchy. And although the Theologians, authorized by the holy Writ, suppose that Sort of Subordination among those *Celestial Intelligences*, it would be a criminal Error in them to imagine, that those different Mansions, render their Felicity more or less perfect; that those of the last Hierarchy, are not wholly penetrated and inflamed with the divine Love so as to be reduced to the Impossibility of wishing for more, or that they are not equally happy in the Contemplation of the divine Essence with those of the first Hierarchy.

It is true, we are obliged to believe that Jealousy and Ambition were once introduced into Heaven, that once the brightest, the most exalted of all the created spiritual Intelligences, and the nearest to the Throne of the *Most High*, were seduced by those two dangerous Passions; that, dazzled with the extreme Radiancy of his own Light, seeing himself raised above all the other Hierarchies, and none above him but the *Almighty himself*, with the Help

Of Rebel *Angels*; by whose Aid aspiring
To set himself in Glory above his Peers,
He trusted to have equal'd the *Most High*,
If he opposed; and with ambitious Aim,

†

Against

Against the Throne and Monarchy of God,
Rais'd impious War in Heav'n.—

Milton's *Paradise Lost*.

That this War was terminated by his total Overthrow, and of all his Partizans, the *Rebel Angels*. But how could the being possessed with Pride, Ambition, and Jealousy agree with the Nature of a spiritual Intelligence, impassible, unalterable, and entirely perfect in his Kind? How could that Revolt, Trouble, and Confusion be supposed compatible with the eternal Felicity of the celestial Mansions? is what cannot be accounted for, otherwise than by saying that we are obliged to believe it.

Some of the Fathers pretend, that the original Cause of *Lucifer's* Overthrow, was the Proposal of the Incarnation of the second Person of the *Blessed Trinity*. That God by his divine Prescience, having foreseen *Adam's* criminal Disobedience, and determined by the irrevocable Decrees of his supreme Wisdom, that for the Preservation of the human Race, a Reparation should be made adequate to the Offence, God the Son had taken upon himself that Reparation, which was to be effected in a Manner, which *Lucifer* (who must be supposed to have been ignorant of the Possibility of the hypostatic Union) believing far beneath the Nature of a Supreme Being, thought had rendered the divine Essence inferior to his own, and consequently undeserving to have the first Seat in Heaven, which he supposed then devolved to him, as the more perfect Intelligence, and the nearer to it.

But how could *Lucifer* see in the Contemplation of the divine Essence, the Fall of *Adam*, and the Incarnation of the second Person, as a Reparation for it; and not see at the same Time, that he was to be the Occasion of those great Changes? That the Incarnation was to be preceded by *Adam's* Disobedience, and *Adam's* Disobedience by his seducing *Eve*; after having been himself first banished Heaven, in Punishment of his Ambition and Temerity? If *Lucifer* saw all those Changes (as certainly he must have seen them all or none) why did he not prevent them, by contenting himself with his happy Station, since thereby he must have been convinced, that acting otherwise, should infallibly be the Cause of his entire Ruin? Could it be supposed that *Angels* were created less perfect than Man was, whose Passions in his State of Innocency were so well subordinated to one another, so regular among themselves, and had continued so, if there had not been, then, a crafty Tempter of *Mankind*? which was not the Case of that spiritual Intelligence, who mistook perhaps his extravagant Ambition for a Mark of the Sublimity of his Apprehensions, and consequently look'd upon it rather as a Perfection, than a Crime deserving an eternal Punishment.

Those who admit of no *Evil Spirits*, consider this Point of a Christian Belief, as a fabulous Story, invented by some *Enthusiasts* to frighten the Vulgar. They cannot be persuaded that it is agreeable to the just Notions we must have of the Equity and Justice of the suprem Being, to believe that he would have created a spiritual Intelligence, and by placing him nearer his Throne, take Occasion from thence, not only to accelerate his Ruin, but also to make him subservient to that of others; for, say they, (supposing the History true) there is rather more Appearance of Cruelty in the Condition of the fallen *Angels* than in that of *Adam*, after his Disobedience; since at the same Instant, *Adam's* Fall was foreseen, a Sacrifice was prepared in Expiation for it: But that of the *Angels* was foreseen (and all that's foreseen by the All seeing Omnipotent must infallibly happen) without Resource or Remedy. In that Sense *Adam* was to fall, but he was to meet on the Brink of the Precipice, with a strong and powerful Hand to hinder him from falling to the Bottom; the *Angels* were to fall, and before their Fall, that bottomless Abyss,

from whence there's no Redemption, was opened to receive them.

A Dungeon horrible on all Sides round,
As one great Furnace, flam'd; yet from those Flames
No Light, but rather Darknes visible,
Serv'd only to discover Sights of Woe:
Regions of Sorrow! doleful Shades! where Peace
And Rest can never dwell! Hope never comes
That comes to all; but Torture without End
Still urges, and a fiery Deluge, fed
With ever burning Sulphur unconsumed!
Such Place eternal Justice had prepared
For those rebellious.— Milton's *Paradise Lost*.

If it is not a sacrilegious Presumption to attempt to fathom the Depth of the *Almighty's* incomprehensible Judgments, we could ask why so great a Difference is made between two Criminals, equally guilty, since they had both offended a *Supreme Being*, to whom they were both equally indebted for their Origin; nay, if, in this Case, we were to consult nothing else but our weak Reason, the rebellious *Angels* would appear to us less guilty than *Adam*; since the Temptation was not so great on his Side. *Adam* was created as perfect in his kind as the *Angels* were; he found himself all at once absolute Master of all that was offered to his Sight, with an unlimited Power of disposing of it at his Pleasure, a single thing excepted, which, by the little Notice *Adam* had taken of it, must have appeared to him far beneath his Wishes; *Adam*, besides, knew nothing above him which could flatter his Ambition, but his divine Creator himself, who never appeared to him with that Immensity of Glory, he was contemplated in by the *Angels* in Heaven. And if he had, *Adam* was created with so just an Idea of the infinite Distance between him and the Supreme Being, that he could never have been tempted to pretend to an Equality with him.

But the rebellious *Angels* had all those Disadvantages on their Side; for, to believe them guilty, we must necessarily suppose them created subject to Passions (which in some measure is contrary to the Nature of a spiritual Being, whose Faculties being not wrapt up in Senses susceptible of Impressions from material Objects, should not be subject to Changements or Vicissitudes, but always continue in the same Subordination among them; and the Harmony they were first created with.) Those Passions must have conquered their superior Faculties at that very same Instant (which Instant, in a spiritual Intelligence, runs so swift, that it cannot be defined nor described) of their Revolt, since none of the antient Fathers are agreed on the Duration of the Felicity of the fallen *Angels*, and most of them are of Opinion that there was but a short Interval betwixt their Creation and their Fall, and consequently had not the least Moment allowed them to reflect on their Folly, or to repent; nay, if we must believe the Holy Writ, it was not decreed in the unscrutable Councils of the *Holy Trinity*, they should repent, since the Place for their Punishment was prepared before, or at the very Time of their Fall; if before, the Punishment was foreseen at one and the same Instant with their Fault (and if we may be permitted to speak as a Philosopher, not as a Christian) were both of an indispensable Necessity, since God's Prescience is, as irrevocable, as are his Decrees; or rather, both are but one and the same thing; if after, they must likewise have been punish'd, since the divine Creator has never form'd or created any thing in vain; and that Place of Torment is specially specified in the Scripture, as design'd by him for the Punishment of the fallen *Angels*. Therefore lest we should lose ourselves in this Labyrinth, whose intricate and difficult Parts the divine Providence has judged proper to hide from us, we must content ourselves with seeing it afar off, and silence all our rational Faculties, when they attempt to discover what's above their limited Penetration.

What

What we can say more upon this Subject, is, that those unfortunate Beings, created first in so much Splendor and Glory, that their Chief or Leader was called *LUCIFER*, *Light-bearer*, have been represented to us, since their Fall, under so many frightful Figures and Shapes, that we must torture our Imagination, to persuade our Reason, that all that's said of their pristine Grandeur and Glory, or of their present unfortunate State, is not a Fiction, invented with no other Design than to frighten a weak Mind; some even have the Impiety to doubt of their Existence, and cannot imagine that it is agreeable to God's Equity, Justice, Mercy and Compassion (the greatest of all his Attributes) to punish a first and transitory Fault, with an Eternity of Torments.

The Truth is, that all that's said of the different Shapes and Figures of the *Rebellious Angels*, vulgarly called *Devils*, is nothing else but a mere Allegory; and all that's painted of them, the pure Imagination of a Painter; the *Evil Spirits*, being spiritual Substances, existing by themselves, as well as the blessed ones, have no Shapes, no Horns, no Tail, nor none of those other Implements they are represented with. The Scripture itself, (*St. John* excepted) when it mentions the *Devil*, don't speak as if it had ever been seen, but only heard.

'Tis true, that those Sorts of Representations make a stronger Impression on some Minds, than all the most pathetick Discourses of the greatest Orators; and that some Christians would hardly believe that there was a Fight in Heaven, whose uninterrupted Peace, they consider as an essential constitutive Quality thereof, if they were not to see the Dragon under *St. Michael's* Feet.

Some Authors are pleased to tell us, that the *Devil* himself has been sometimes very much provoked to see himself represented under those hideous Figures; and above all, at a Painter in *Flanders*, who having painted the *Archangel St. Michael*, for an *Altar-Piece*, in a Manner far exceeding all that had ever been done before him; in the Representation of the *Devil*, whom he had placed, as usual, under the *Archangel's* Feet, but so much Monster-like, that the *Devil* himself was frightened at it, and so enraged, that to be revenged for the Affront, he took the Resolution to spoil, for the future, all the Painter's Works, of any kind whatever; which he executed so punctually, that he was never more surprized than to find every Time he came into his *Laboratory*, that his Works had been touched by some *evil Hand*.

But however, the *Devil*, who is not perhaps always so ill-natur'd, as imagined, and perhaps has some good Intervals; tired of his Revenge, and seeing that the Painter's Ruin must be unavoidable, if he was to continue to plague him in that Manner, took the Resolution to pay him a Visit, and expostulate the Matter with him; accordingly, having dressed himself in the best Manner he could (*i. e.* very magnificently, for the *Devil* must have a very sumptuous Wardrobe) he entered one Day the Painter's Laboratory, while he was at work. The *Painter* (who being a great Master of his Art, and as such, used to be visited by Persons of the first Rank, Strangers and others) received his new Guest with his usual good Manners and Civility, reached him a Chair, and they both began a Conversation on the Excellence of Painting, (on which Subject *Lucifer* spoke very pertinently) admiring all the while, the inimitable Strokes of his *Illust.*; which gave him an Opportunity to complain of the many Accidents happened lately to his Paintings. His Guest, after having condoled with him of the Atrocity of the Injury, asked him if he did not know somebody malicious and spiteful enough to be the Author of it? To which the Painter answered, that he had taken all the Measures necessary to discover him, but yet to no Purpose.

At last, the *Devil* was pleased to discover himself, and declare that he had done all the Mischief, induced to it by the hideous Figure he had made him

make, under *St. Michael's* Feet, at such a Place? What could engage you, said he, to paint me in such black Colours? Look upon me, am I so frightful, as represented by you? The Painter, who viewing him then from Head to Foot, saw no Deformity in him; but on the contrary, that he was really a fine Gentleman to look at, acknowledged his Mistake, and protested he was ready to make all the Attonement and Reparation, he could reasonably wish for, or expect from him, provided he would for the future stand his Friend, or at least, not treat him as an Enemy. The *Devil*, who scorned to be rivalled in Generosity, asked no other Reparation, than that he the *Painter* would, as soon as possible, put a golden Crown, upon that hideous Figure of his, which had occasioned all the Mischief, and which on these easy Conditions would cease. The Painter promised he would, and the next Day accomplished his Promise, and ever since, the *Devil* and he kept a very friendly Correspondence.

The *Ethiopians* paint the *Devil* white, in Contradiction to our Manner of painting him black; and the *Americans* (if we believe all that's written of that Country) worship him but through Fear, for as far as I can find, no Nation has a very true and sincere Love for the *Devil*. Though their *Devil* is not to be taken in the Sense of the Scripture; since those People have only an Idea of two collateral independent Beings, one whereof is good, and the other evil; and they place the Earth under the Direction of the evil Being; which our Authors, with some Impropriety, call the *Devil*.

Some are extravagant enough to believe the *Devil* under Men's Commands, which when communicated to him at such and such Places, and in such and such Manner, he punctually obeys, as the Conjurers, *Pithonesses*, Fortune-tellers, &c. which is a Folly in those that believe it, deserving *Bethlehem*, and a Piece of consummate Knavery, in the Impostors who countenance them in it, punishable with the Gallows.

Frier Bacon, *Dr. Faustus*, &c. if we believe the Romances of those Days, were very familiar with the *Devil*, and used to be frequently and friendly visited by him.——People were of Opinion, that one might be instructed how to raise that honourable Gentleman, in Order for a Conference with him, in two Books which I never had the Curiosity to read, one called *Agrippa*, and the other the *Little Albert*; though I have heard of a *Frenchman*, who having met with one of those Books, in the Library of the *Franciscan* Fryars, at *St. Brien* in *Britanny*, in *France*, had in Effect, made Use of it to raise the *Devil*, who obeying his Commands, and appearing to him; the over curious *Frenchman* inquired in particular after the Welfare of some Persons, by whom he had been ill used, while they were living, and whom therefore he supposed to be in Hell; and having imprudently, if not impudently pretended, and divulged afterwards, that the *Devil* had really assured him that those Persons (some of them of a very noble Family) were there, the Relations of those deceased Persons had the *Historian* secured, in a Place very proper for a Conference with the *Devil*, from whence he could not be released, till after he had made a gentle Cavalcade through the Town, with an *Alert valet de Chambre* at his Heels, who being over diligent, brushed his Buff oftner than he could wish.

Having alledged all the Reasons for and against the Existence of the rebellious *Angels*, we must inquire at present if the Existence of the blessed ones, is agreeable to the Christian Belief; or rather if we are obliged, as Christians, to believe the Existence of *Angels*.

All the Fathers answer in the Affirmative, because *Angels* are mentioned throughout the Old and New Testament. God placed *Cberubims* at the East of the Garden of *Eden*, *Gen. ii. 24.* *Abraham* entertained three *Angels* near his Tent, *Gen. xviii. 8.* The *Angel Gabriel* was sent to the Virgin *Mary*, *Luke i. 26.* An
*
Angel

Angel informed the Shepherds who were keeping their Flocks near *Bethlehem*, of the Birth of our Saviour; *Luke* ii. 9. besides an infinite Number of other Testimonies of the *Angels* Existence; and so obvious, that no Body acquainted with the Scriptures can call it in Question, or deny the Existence of a spiritual Intelligence, so well supported by that divine Authority, which is the Foundation of all Religion; and by which alone we are to be directed in our Belief: The Facts are so well circumstanced, the Proofs are so plain, and so free from all Ambiguities or Amphibology, that no Body can deny it, without being an Heretick of the first Class.

'Tis true, that the Existence of *Angels*, is not to be demonstrated by Strength of Reasoning; but only by the most essential Articles of our Belief; such as the *Trinity*, the Incarnation, the Resurrection of the Dead, &c. which are much more above our Apprehension than this; and nevertheless, we are obliged to believe every one of them. For those, we must form our Faith entirely on a simple Revelation; and for this, we have that Revelation supported with Facts, confirmed by a written Tradition; though that very same written Tradition, has left us in the Dark, as to the Time when *Angels* were created, since *Moses* contents himself with telling us, that in the Beginning God created the Heaven and the Earth, *Gen.* i. 1. without taking the least Notice of *Angels*, which are not mentioned, till the latter End of the third Chapter of the same Book. Could the Legislator of the *Jews* have supposed the Formation of that vast and miraculous Piece of *Mechanism*, Heaven, (whose single Motions have so long puzzled the most subtle Philosophers) of so little Consequence, as not to deserve his Attention or ours? Or is it because he knew nothing of it himself? For if he did, he had done a very great Service to his Descendants, in informing them, how, and by what Kind of created Beings it was peopled at first; and in particular, of all the Incidents of that great Fight, between *Michael* and the *Dragon*.

Thomas Aquinas, *prim. part. quest. b. 1. art. 3.* supposes it very probable, that *Angels* were created at the same Time with the corporal World. Though 'tis said in *Job* xxxii. 7. that the *Angels* praised God, while he was creating the World, which supposes *Angels* to be pre-existent to the World.

The same *Thomas Aquinas*, in the same Part, *Quest. b. 2. art. 1, 2, 3, 4, 5, 8.* pretends, that *Angels* were not created *in termino*, i. e. in a State of Glory, or of a supernatural Beatitude, but in a State of Grace, and of a natural Beatitude; in which being free from all Necessity, either *intrinsic* or *extrinsic*; or to speak in more intelligible Terms, being not necessitated in their Acts, by either interior or exterior Impulsion, they could, with the Succours or Assistance of a supernatural Grace, deserve a supernatural Beatitude, or Felicity.

Hence *St. Augustine*, *lib. 12. de civitat. Dei, c. 9.* thus speaks of the Free-will of *Angels*, *He, God, has created them, (the Angels) with a Good-will, i. e. with a chaste Love, whereby they could adhere to him, giving them Grace, to assist them therein, at the same Time he formed their Nature. Qui eos cum bonâ voluntate, id est cum amore casto, quo illi adhererent creavit, simul eis & condens naturam, & largiens gratiam.*

They could with a single Act of *Charity*, i. e. of Love of God, obtain a supernatural Beatitude, as a Man could by a single Act of the same Love, acquire the same supernatural Beatitude, if his spiritual Intelligence, was free from a corporal one.

When *Angels* had once obtained that Beatitude, it remained no longer in their Power to sin; but their Will was fixed in a supreme and eternal Goodness, in the same Manner the Souls of the Blessed, lose by the Fruition of an eternal Happiness, the Power of doing ill.

Therefore, as by a single Act of *Charity*, the blessed *Angels* could obtain the Favour of being confirmed in the Possession of an everlasting Good; like-

wise the rebellious *Angels*, by a single Act of Pride and Ambition, deserved an eternal Damnation. Which Argument resolves all the Difficulties, heretofore started by me, with Regard to the Condition of *Angels*, at the first Instant of their Creation, that though of an immortal Substance, they were not created (no more than we Mortals) for the immediate Fruition of an eternal Felicity. The Difference between Man and them was, that their Beatitude depended on a single Act of a divine Love, of which they had the excellent Object present before them, in whom they could discern, from the first Instant of their Creation, all that could excite that divine Love within them; while the same Beatitude was promised to Man, only as a Recompence for a long Series of repeated Acts of the same Love, to which he was no otherwise incited, than by the Idea of a Supreme Being, and the Sentiments of Gratitude, infused into him; at the same Time his earthly Structure was informed with a rational Soul; and then he had other Objects to divide that Love, which meeting with no such Opposition in *Angels*, was wholly centered in the divine Object.

It might be asked in this Place; if that truly seraphick Love, was equally perfect in all the blessed *Angels*; and if the Difference of their Hierarchies does not proceed from its different Degrees of Perfection; or rather, if that Division of *Angels* into Hierarchies, is real, or imaginary only? My Sentiment is, that as the Felicity of the celestial Mansions, consists entirely in the Love of God; and that we are informed that there are several Orders of *Angels*, some nearer the Throne, and others at a greater Distance; that Difference must be understood of the different Degrees of Love, and of nothing else; though that sacred Love is in all and every one of them, adequate to their Faculty: So that though a *Seraphim* is more inflamed than a *Cherubim*, with that divinely consuming Fire, nevertheless a *Cherubim*, as a *Cherubim*, loves as much as a *Seraphim*; and so of the rest of the Hierarchies.

As to the second Part of the Question, it seems very probable, that each Hierarchy is a different Species of *Angels*; though *Thomas Aquinas*, *prim. part. quest. 50. art. 4.* is of Opinion, that there are as many Species of *Angels* as there are *Angels*; because, says he, *Angels* being spiritual Substances, free from all Sort of Matter, they have not in them a Principle of Individuation, whereby they could be multiplied in Number, under the same Species; which Sentiment of *Thomas Aquinas*, is not agreeable, in every particular, to the Notion we must have conceived of a spiritual Substance, from a Number of rational Souls, which while they exist are single, and only distinguished by Number, though they are all of the same Species: Likewise a Number of *Angels* having been formed on the same Idea, by God, may be distinguished by Numbers.

Another Thing, concerning *Angels*, which is much controverted in the Schools, and among the different Sects of Christians, though admitted by the *Roman Catholics*, and several other Denominations, is, if it be really true, that every one of us has his Guardian Angel?

St. Hieron is of that Opinion, founded on this Passage of the Scripture, *Matt. viii. 10. Take Heed that ye despise not one of these little ones; for I say unto you, that in Heaven their Angels do always behold the Face of my Father which is in Heaven.* Which Passage is sufficient to refute all the sanatical Objections of those pretended Christians, who accuse of Superstition, all those who adhere to it. For my Part, I believe that those who reject this Article as superstitious, must reject this Passage of the *Evangelist*; for there's none couched in clearer and more express Terms. I would ask them who are those *Angels* mentioned by Christ himself, to be the *Angels* of little Children? and what is their Office? not to pray for them, I hope? for such Opinion would smell of Superstition and Popery indeed; to hear their Prayers,

and grant their Requests, another Error worse than the first? No; it must be then, for nothing less but to defend and protect them against all the Assaults of the common Enemy of Mankind.

Instructed, by their continual Contemplation of the divine Essence, in whom they see all Things created, and uncreated, that all that's in Heaven and on Earth, was formed by that *Supreme Being*, (who makes their whole Felicity) to evidence the Immediacy of his divine Perfections, and advance his Glory, and that MAN in particular (whom he had distinguished from all the rest of the Creatures, by forming him to his Image and Resemblance, and whose Nature was exalted even so far above theirs, as to be united by an incomprehensible *Hipostasis*, with the Divine) instructed, says I, that Man, was his chief Care, and that all other sublunary Things were created to be subservient to Man's Preservation, whose Understanding, ever since his Fall had been weakened, his Imagination vitiated, and his Will depraved and corrupted, and therefore must deviate from the right Way, if not strengthened, or directed by some superior Assistance, they, the *Angels*, (still more powerfully excited to it by that pure, uncorrupted, unalterable, and divinely inflaming Love, the Principle of all their Actions) take that Care upon them, assisted therein by the Irradiation of that Grace, without which, *nihil sumus, nihil possumus*, we are nothing, and can do nothing, towards the Advancement of our eternal Felicity.

How pleased are those our holy Guides in the Way to Salvation, when they see that, sensible to the divine Inspirations, we enter that narrow and intricate Road with Pleasure and Alacrity, and follow it without deviating to the Right or to the Left; and when we meet with very difficult Paths or stumbling Blocks, how ready they are to lend us a helping Hand, or rather to act in Concert with the GRACE, towards our Preservation; what Pleasure, what Satisfaction for them, when we once again recover our former right Road, and how sorrowful, when we have entirely forsaken it? I say sorrowful, since it is the Opinion of the *Fathers*, that those spiritual Intelligences are sensible, in their Manner of Sorrow and Pleasure, at *Christ's Passion*, *Angeli pacis, amarè flebant*, the *Angels* of Peace wept bitterly.

Are then, the *Angels* present every where with us? Spiritual Substances, like *Angels*, cannot be said properly to be in a Place; since that belongs only to corporal or extended Substances; but however, to resolve this Difficulty, the *Theologians* have distinguished two Manners of Being in a Place, *viz. Circumscriptivè*, and *Definitivè*.

To be in a Place, *Circumscriptivè*, is when each Part of the Part contained in that Place, answers to every Part of the Place, or is environed with the *Superficies* of the Body 'tis contained in, like a human Body, whose Head is in one Part of the Place, and the Feet in another; and this Manner of existing or of being in a Place, belongs to a *corporal*, not to a *spiritual Substance*.

To be in a Place *Definitivè*, is likewise to be Present in a certain definite Place, but not so as to be *circumscribed*, surrounded or environed with that Place; and in this Manner the spiritual Substances are said to be in a Place; like the *Angel Gabriel*, who was present in the Chamber of the *Virgin Mary*, when he saluted her as Mother of our divine Saviour, though he was not environed with the *Air* of that Chamber.

Angels move in the same Manner they are present in a Place, that is to say, that by their Thought or Imagination, they can be present at several Places at once; in that Manner our Imagination is present where we are, and at the remotest Parts of the World at once; and would be perhaps carried in a Moment, in its own proper Substance, to those Places, if the Body was not an Obstacle to it.

When *Angels* change Places, they have no need to pass through an intermediate one; the same as our

Thought, when carried from *London* to *Paris*, has no Need to pass through *Picardy* or *Flanders*. Since that Imagination which is in *London*, the very next Moment can be in *Paris*. Though these Motions are not made by the proper Substance of the Mind, because it is then united to the Body: But was our Mind once separated or freed from our Body, like an *Angel*, it would move as easily as it thinks, and would not appear to be any where else, but where it thinks; so that if our Mind was then to think of *London*, *Paris*, *Rome*, and other Places, it could be said to be present at *Rome*, *London*, *Paris*, &c. Not that our *Soul* would be present in those Places, in the same Manner I am here sitting in my Chair; but only as a spiritual Substance, by its Faculty of Thinking; since our Spirit or Understanding don't seem to exist otherwise than by that same Faculty of thinking, *Cogito ergo sum*.

As for the *Angels* Knowledge, the *Roman Catholick* Theologians are of Opinion that *Angels* have received from God, a natural Knowledge of Things, both visible and invisible, which was given them as soon as they began to see God with their spiritual Eyes, *Intuitivement*, or Face to Face; for, they see in God as in an *intelligible Light*, all that God is pleas'd to reveal to them; therefore, conclude these *Roman Catholick* Theologians, they know our Wants, and hear the Prayers, which through their Mediation we address to God. They are not Strangers, say they again, to our good Deeds and Actions, as the *Archangel Raphael* was pleased to assure *Toby* in these Words, *Tob. xii. vers. 12. Quando orabas, cum Lachrymis, et sepeliebas Mortuos, et derelinquebas Prandium tuum, et Mortuos abscondebas per Diem, in Domum tuam, et Nocte sepeliebas eos, ego obtuli Orationem tuam Domino.*—When thou wast wont to pray with Tears, and to bury the Dead; to leave thy Meals, and hide in the Day-time, the Dead in thy House; that thou mightest bury them at Night, I have offer'd thy Prayer to the Lord: But this Passage being taken from the *Apocrypha*, and the Invocation of Angels condemned as superstitious in the Protestant Church, I must not approve of it.

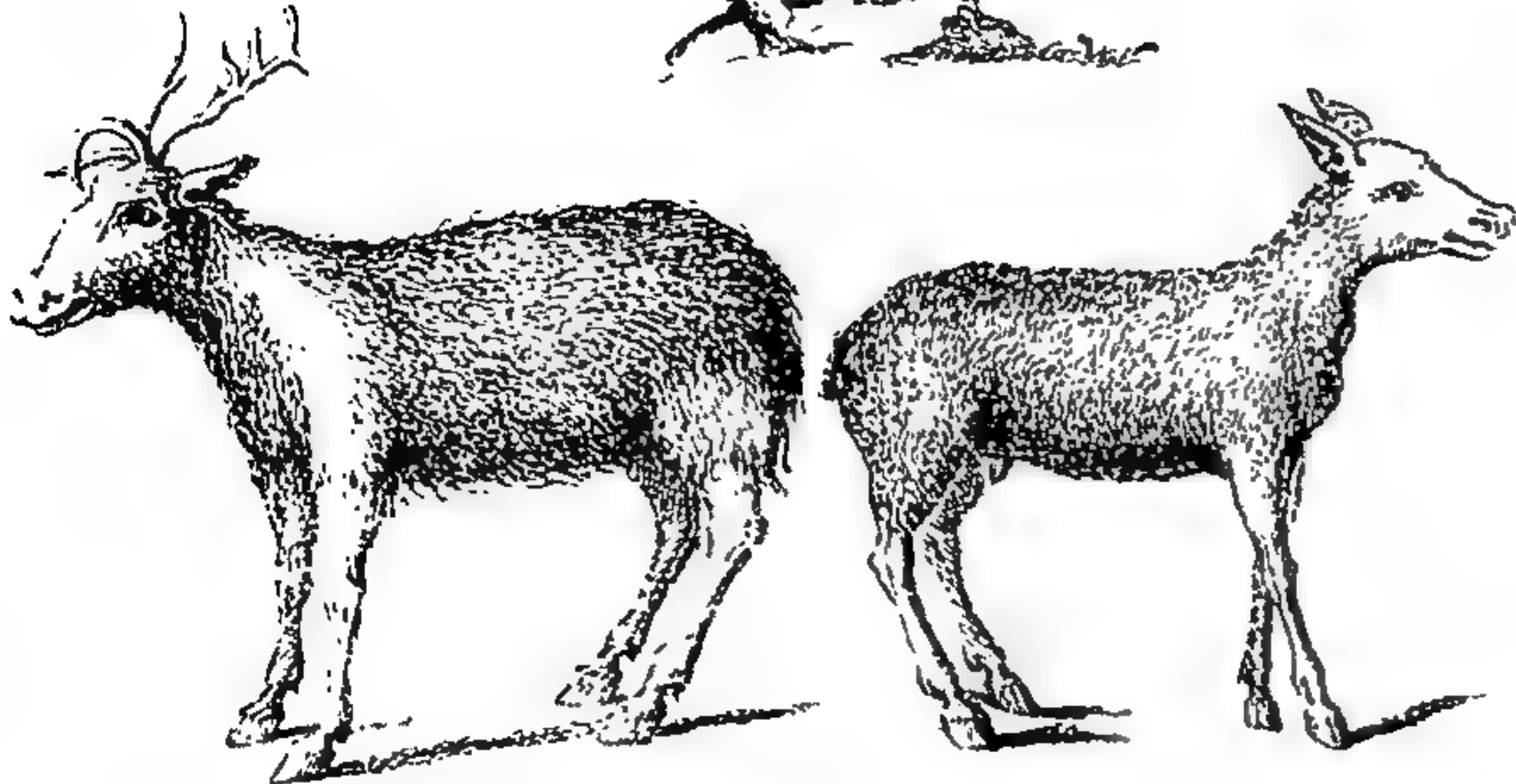
Thomas Aquinas believes, that notwithstanding the *Angels* great Knowledge, some of our most secret Thoughts are entirely hidden from them, and known to God only, who is alone the Scrutator of our Hearts.

As for the evil Spirits, or fallen Angels, they know a great deal less than the blessed ones; neither can they penetrate or discover our most inward Thoughts, unless they be directed to them; nor even then but by meer Conjectures, *i. e.* from our Works or Motions, and by a Sort of Reasoning peculiar to them; for the *Angels* have a Manner of Reasoning quite different from us, never drawing their Conclusions from the Premises, as it appears from the Tempter of Mankind, when he approaches *Jesus Christ*, *Mat. iv.* To endeavour to discover by his Answers if he was really the *Son of God*.

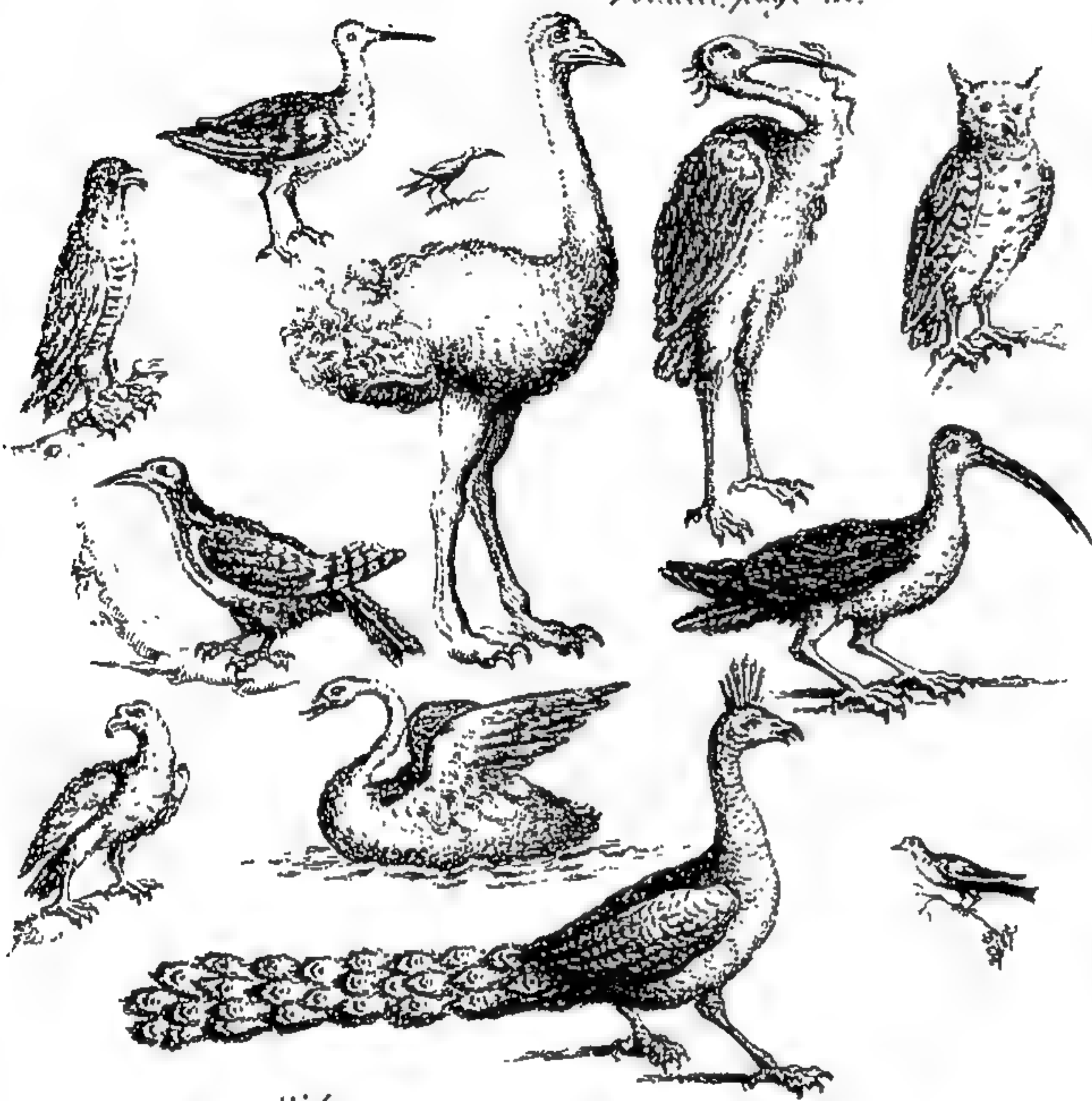
The *Angels* Language, or Dialect, is nothing but the Direction of their Thought between them; the same as if the ALMIGHTY had established a Method among us, that by Means of some Signs or Sounds our Thought should be manifested. Therefore it is very probable, that an *Angel* can by his *sole Intention*, or Will, communicate his Thought to another *Angel*, or even to *Men*.

The Existence of *Angels* is not only admitted by almost all Christian Societies, or Sects, but likewise by the *Pagan* Philosophers, and Poets, as is shewn by *St. Cyprian* in his Treatise of the Vanity of Idols; from the Testimonies of *Plato*, *Socrates*, *Trismegistus*, &c.

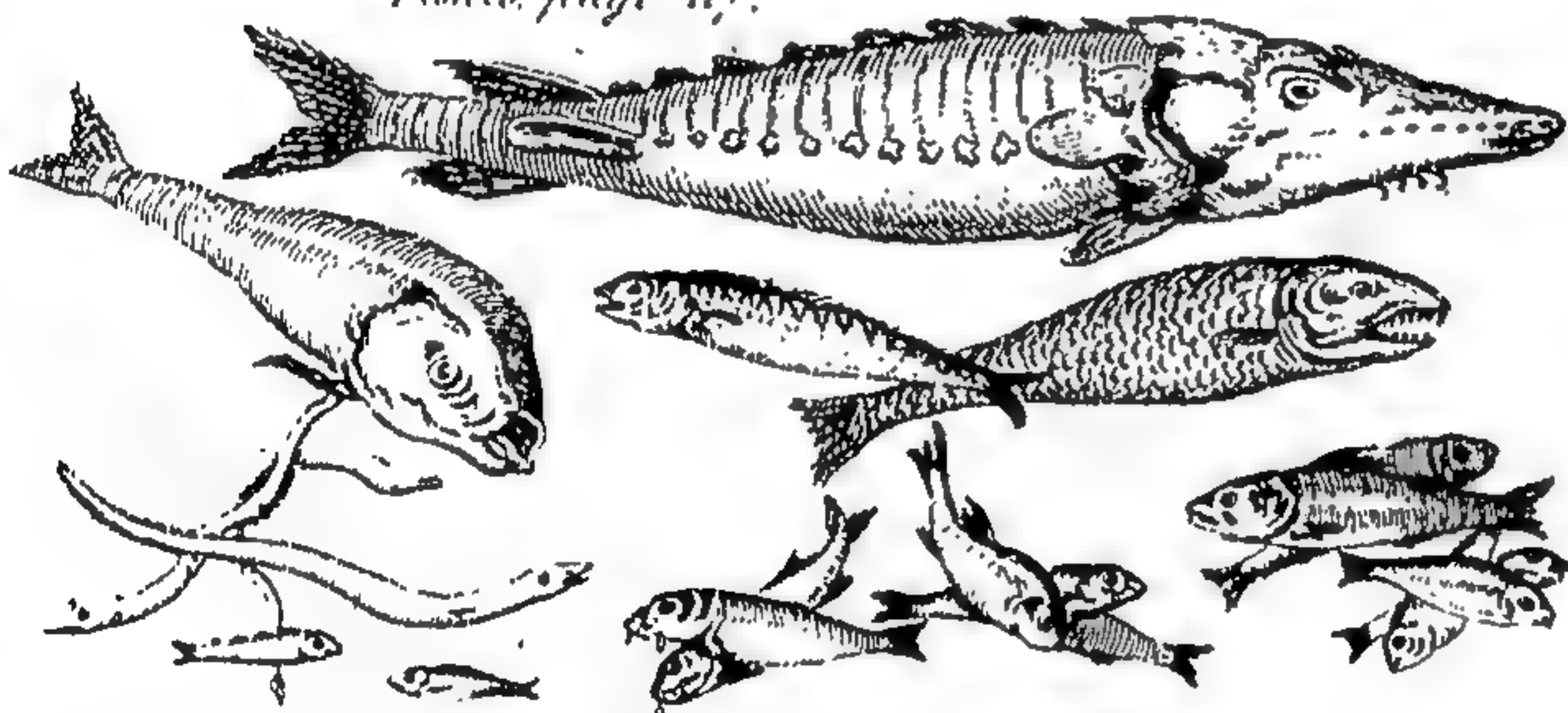
In the *Alcoran* we find frequent Mention of *Angels*.—The *Musselmans* believe them of different Orders, or Degrees, and destined for different Employments, both in Heaven, and on Earth. They attribute exceeding great Power to the *Angel Gabriel*; from whom



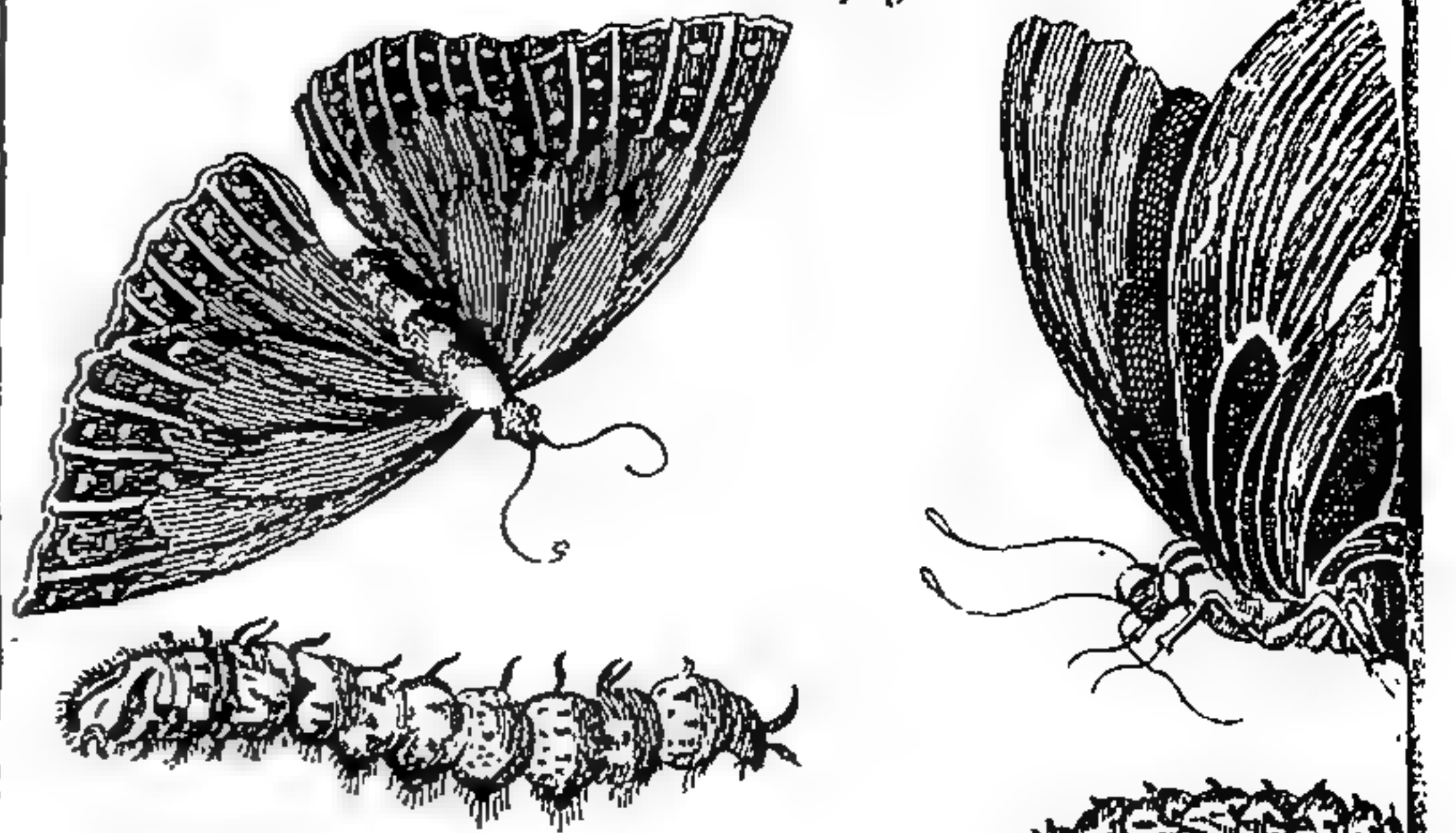
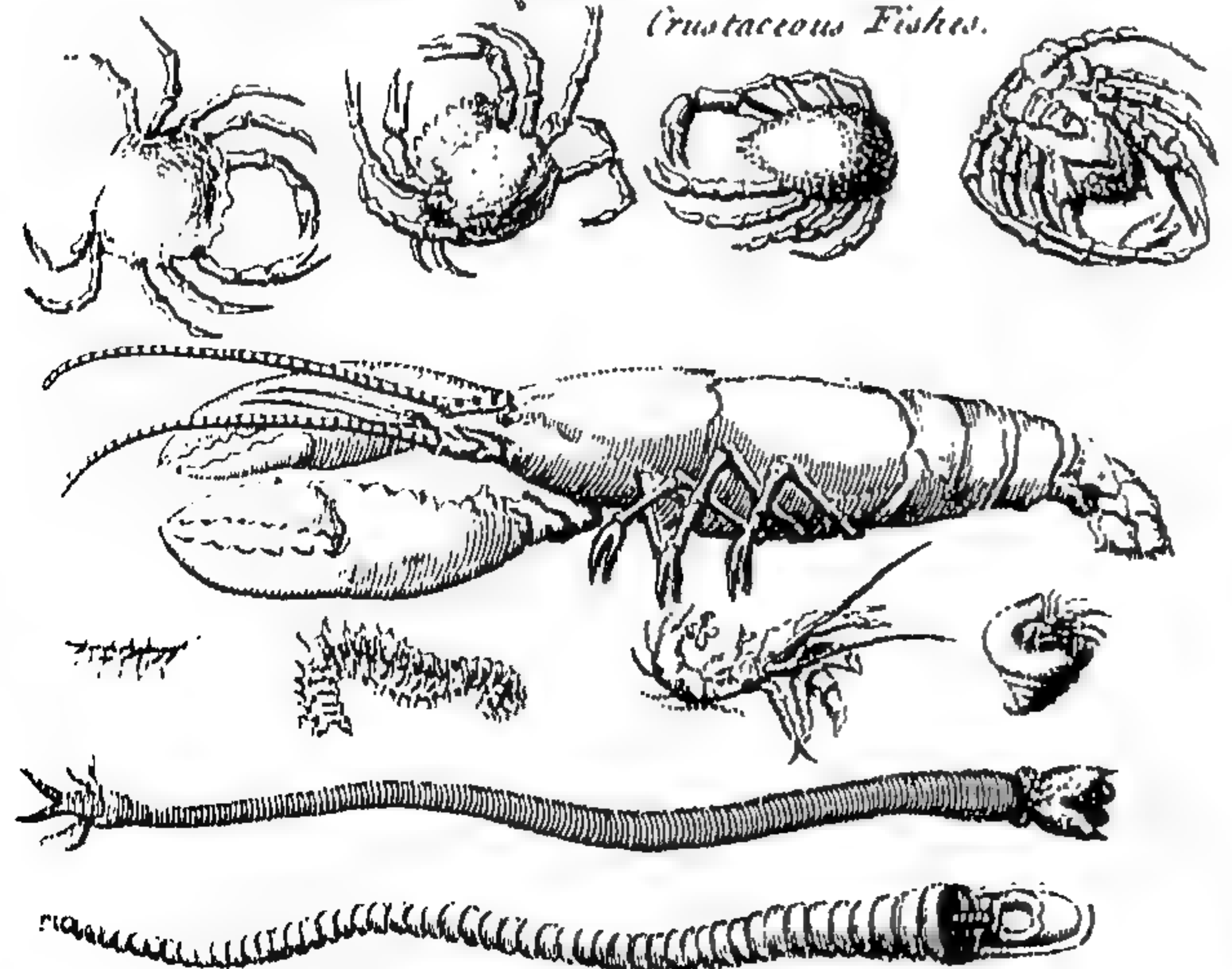
Volatile, page 118.



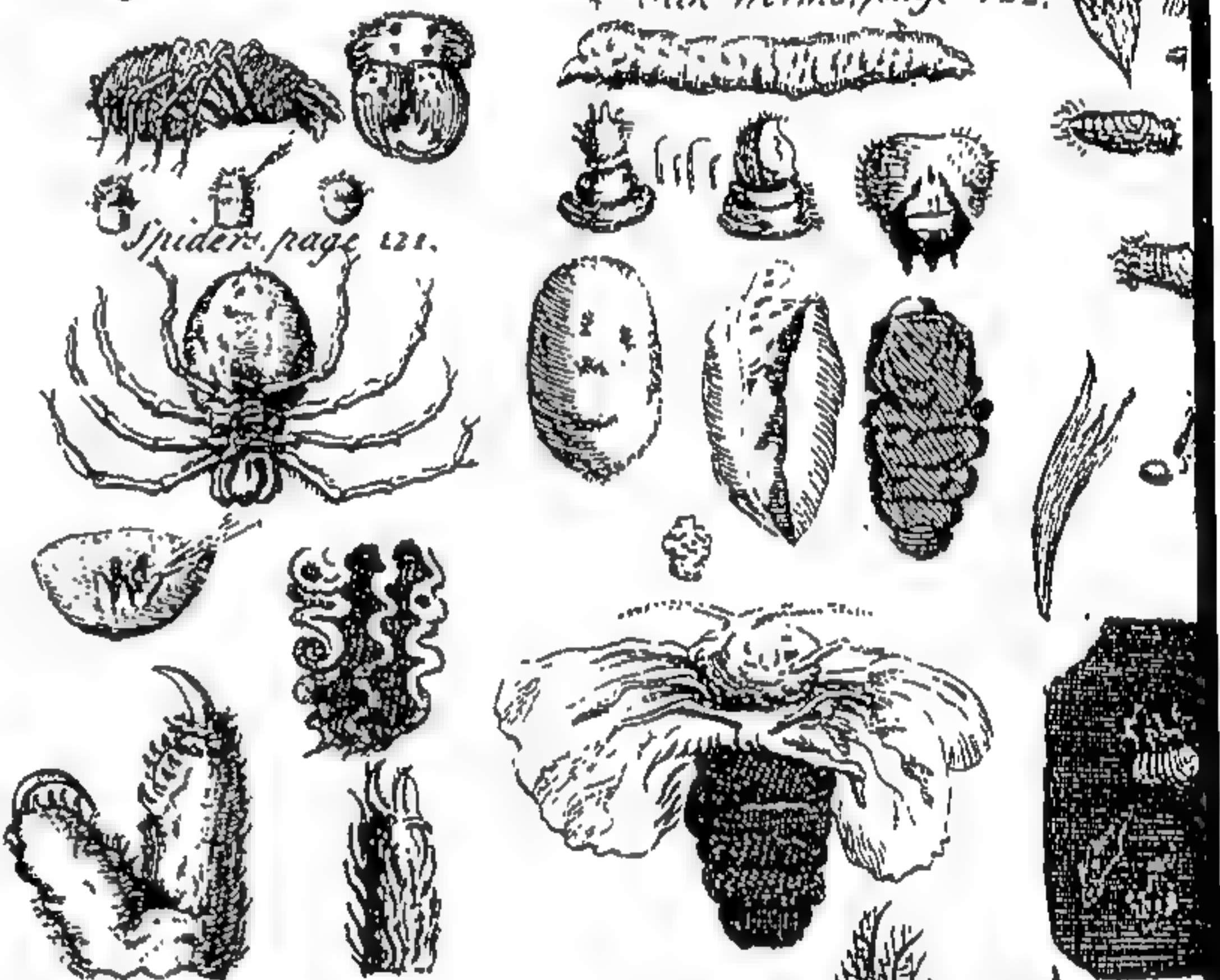
Fishes, page 117.



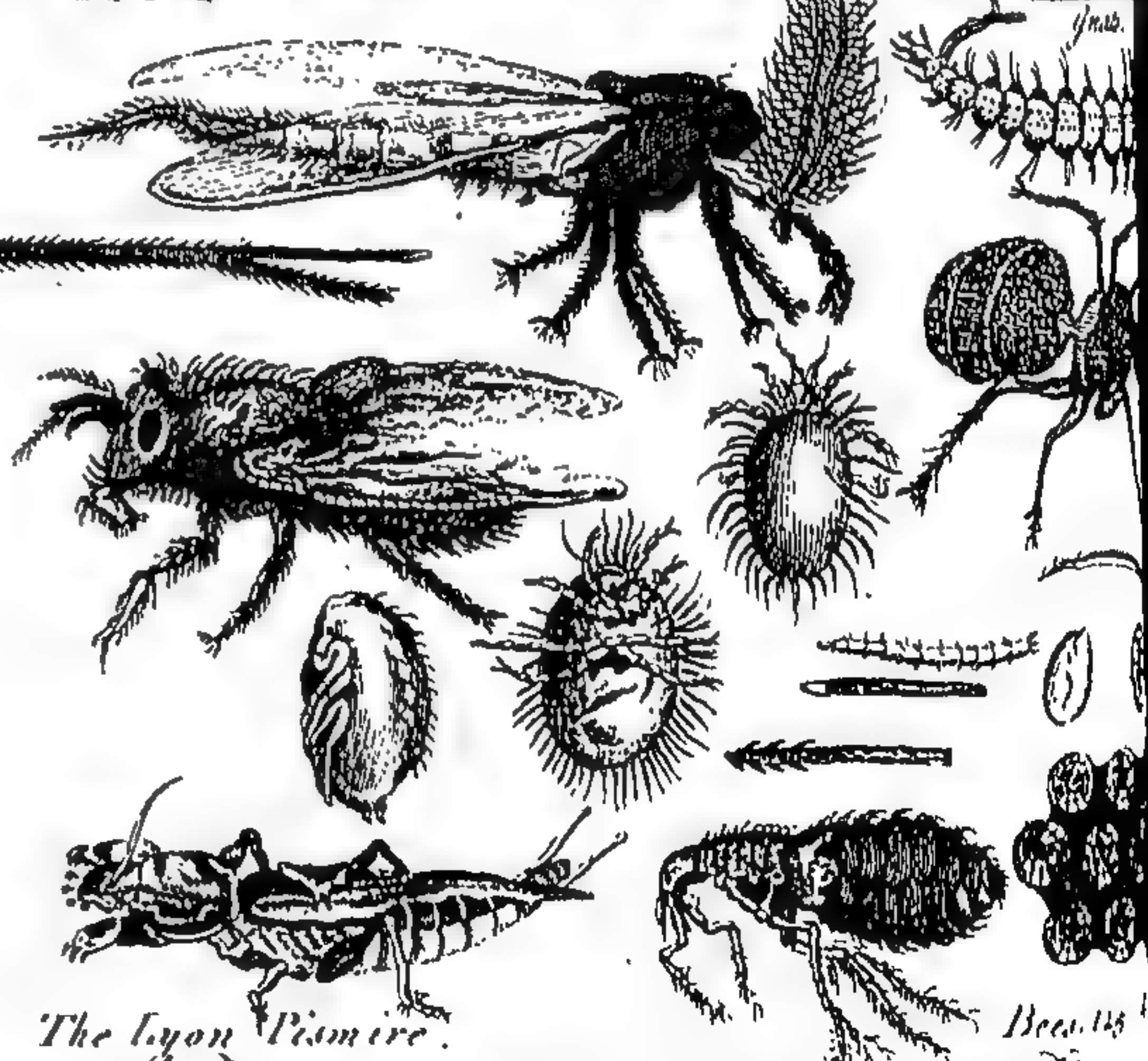
Crustaceous Fishes.



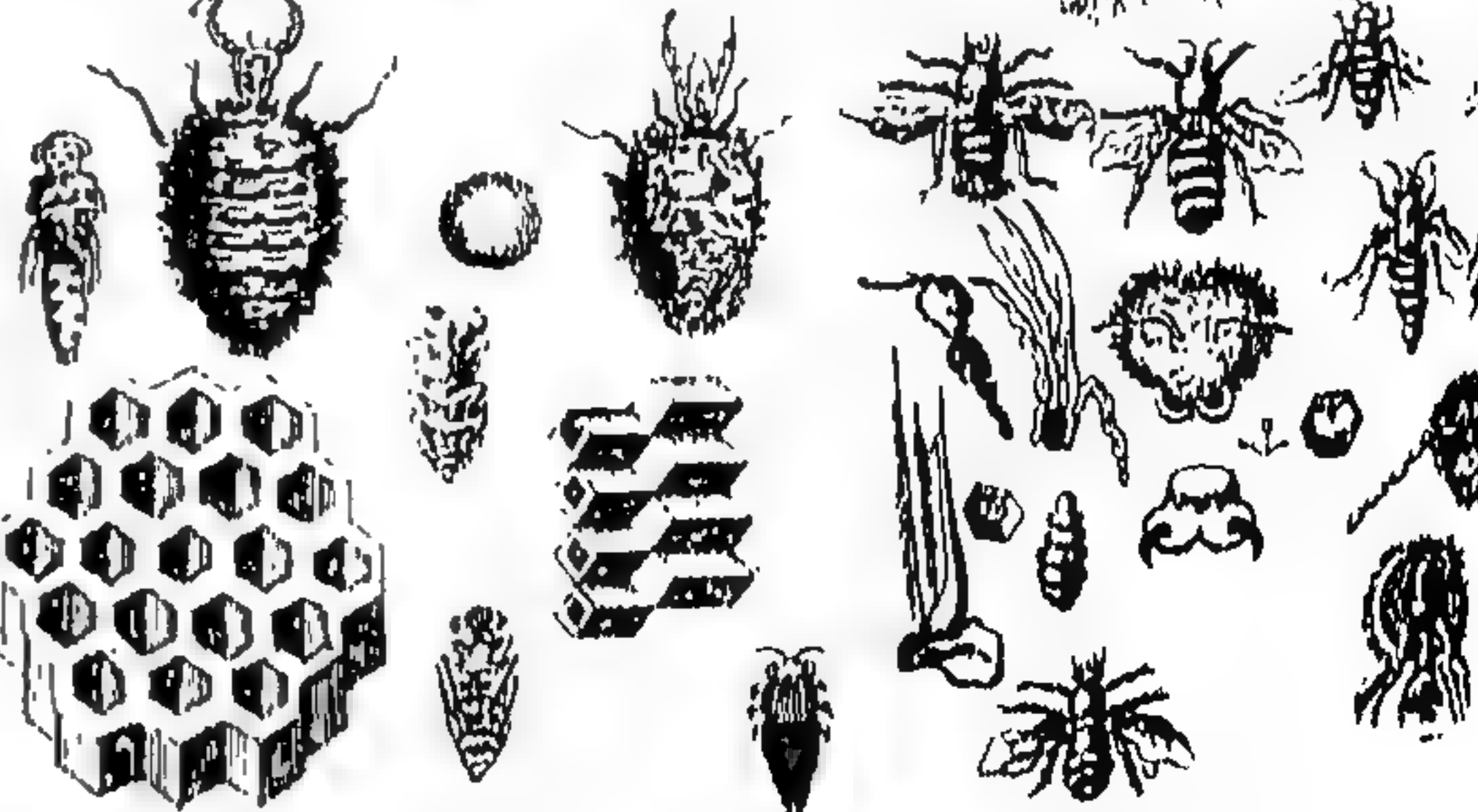
Silk Worms, page 122.



Spiders, page 121.



The Lyon Pionire.



Bees, page 123.

whom the Impostor *Mahomet* pretended to have received the *Alcoran*, and to have frequent *Teste* a *Teste* with him, &c.—The *Angel Asrael* they suppose appointed to take the Souls of such as die; and

another *Angel* named *Estaphiel*, stands with a Trumpet ready in his Mouth, to proclaim the Day of Judgment.

A N I M A L S.

A N I M A L, is defined by *Des Cartes*, and his *Partisans*, an extraordinary and admirable Mechanism of different Parts, skilfully adapted to each other, whose Motions are owing to the just Symmetry of their various Springs, (without any Respect to a rational or sensitive Soul,) and by *Dr. Boerhaave*, an organical Body, consisting of Vessels and Juices, taking its Nourishment by a Part called Mouth, which conveys it into another, called Intestines, into which it has Roots implanted, whereby it draws in its Nourishment after the Manner of Plants.

According to this Definition an *Animal* is distinguished from a *Fossil*, in that it is an organical Body, and has a Power to direct itself, as to its Nourishment, whereas a *Fossil* is directed to it by an accidental Motion; and from a Vegetable, that it has Roots within itself, and a Vegetable without; which Difference is only in Point of Position, since the attractive Faculty (according to this Author) must be the same in both.

My Opinion is, that this Definition is contrary to all the new Discoveries made in *Anatomy*, to which *Boerhaave* cannot be reasonably supposed to have been a Stranger; and the Reason alledged by *Chambers*, or those who have furnished him with those Reasons to illustrate this Definition, “That the Intestines in an “Animal, are in Reality no more than is Earth, or “the Body it adheres to; into which it sends forth “its Roots, that is, the lacteal Vessels, which thence “draw the Matter of its Life and Increase;” These Reasons seem to me frivolous, if not quite ridiculous; since the Earth has a radical, potential, and actual, nutritive Faculty, whereas the Intestines have no other than an active one for the Separation of the Aliments, and the Direction of the nutritive Juices. The Earth has in itself all the different Salts necessary, not only for the Nourishment of the Vegetable, but likewise for its Production, and the Intestines, the only Power of operating upon those Salts brought to them with the Aliments. The Earth is fertile of itself, and is not exhausted by that Nutrition, and Increase, the Vegetables receive from it; whereas the Intestines are but a barren Soil, equally indebted for their Nourishment to the Aliments, conveyed to them by the Mouth, as the other Parts, to which they are sent by their Ministry. The Vegetables act immediately with the Earth in their Vegetation, while the Intestines, without the Intervention of a second and third Organ, would soon become not only unactive, but also entirely uncapacitated for Action. Therefore the Intestines could be compared with a greater Appearance of Reason to the *Master Root* of a Vegetable, to which the Aliments serve instead of Earth, as well for its Nourishment, as for that of all its other Branches; since all the Vessels which terminate to it, have no greater attractive Faculty than those of the Vegetables, which by the different Position of their Pores, act as perfectly in the Preparation of the Nutrient they receive from the Earth, and the Destination of the Juices, as those of our organical Body, in that of the Nourishment, they receive from the Aliments, convey’d by the Mouth into the Stomach.

This other Reason alledged by *Boerhaave*’s Partisans, that an *Animal* is better defined by its Mouth than by any of its organical Parts, is a Piece of a consummate Ignorance, unless they agree that the organical Body of an *Animal* is nothing more than a meer Machine; since, otherwise, the Definition of an *Animal* must be taken (according to the uncontroverted

Maxims of both the antient and modern Philosophy) from their essential Constitutive, not from their integral or integrant Parts. An *Animal* has never been defined, as Mr. *Chambers* ignorantly supposes, an organical Body, composed of a Heart, Brain, &c. but a rational, or irrational Being, a Definition, which contains the two Conditions requisite for a regular Definition, *viz.* the *Gender*, and the *Difference*; *Animal* being the *Gender*, with Respect to all *Animals* in general, and the Rationality, or Irrationality, the *Difference*.

Besides the Mouth of an *Animal* is nothing else but a meer Machine, which has no natural or organical Motion of itself, and would prove as useless as any of the integrant Parts, if not set to work, like them, by a natural Impulsion of a sensitive Faculty, which cannot be said of the Heart, which is independant, from that Moment all the Parts subservient to it, have been disposed in that just Order and Symmetry, necessary for its Motion, which never come to a Period but with the first Motor itself.

In this Sense, contrary to the *Boerhaavians* Sentiments, a *Fetus*, when once animated, though it don’t feed by the Mouth, is an *Animal*; even that single Circumstance, of the Inutility of its Mouth, is capable to refute their extravagant Opinion, since it is impossible to draw the Definition of a Being, from that, without which that Being can exist; and it is not only evident, but incontestible, that a *Fetus* Existence and Substance can be demonstrated, without the Use of its Mouth, which while in the Womb, and even sometimes after the Birth, is of no other Service to it, than that of a Statue, which cannot be said of the Sensation, which can be supposed *Coeval* to its Existence, from the evident and repeated Acts of that Faculty, at the Birth. Neither can it be objected in Confirmation of this extravagant Opinion, that the Existence of the *Fetus* precedes its sensitive Faculty, since that *Fetus* cannot be supposed to exist as a *Fetus*, ’til it begins to make Use of its organical Parts, which Use is subsequent to its sensitive Faculty, which is the *Primum Mobile* of the whole Machine, and without which the Mouth, Heart, and all other Parts must remain useless.

Boerhaave’s Opinion is new, ’tis true, but all Opinions which are contrary to the generally received Maxims of a natural Philosophy are absurd.

The loco-Motion is not neither a Difference so essential between *Animals* and Vegetables, as to draw the Definition of an *Animal* from it, since there are *Animals*; for Instance, *Oysters*, *Mussels*, *Cockles*, &c. which adhere to the Rocks faster than the Plants do to their Subject; though at the same Time those *Animals* have a sensitive Faculty, which is apparent at their opening or shutting themselves, when the Sea ebbs or flows, and by the Resistance they make against our Endeavours to conquer them; those are accounted real *Animals*, though we cannot discover in *Mussels*, a Mouth, a Stomach, or any other Parts proper for the Reception, Digestion, or Preparation of the Aliments.—The Naturalists who have discovered a Hole in the *Mussels*, which they call its Mouth, though it be an immoveable Part, fastened to one of the Shells, and which consequently cannot seek for Food, but the Food must come to seek it; that such Hole be real, is past all Controversy, but all the Consequences drawn from that Discovery are meer Suppositions or Conjectures.

Animals are divided by Philosophers (for I’ll speak here

here as a Philosopher) into rational, or irrational; and these last subdivided into terrestrial, aquatic, volatile, amphibious Insects, &c.

There is but one Species of reasonable *Animals*, and that's *Man*, whom I define an organical Body, informed and directed in all its Motions, by a spiritual, immortal, impassible, indefinite, and unalterable Substance, called Soul; which the *Epicureans* falsely took to be a subtle Air, composed of their *Atoms*, or primitive *Corpuscles*; the *Stoicks* a Flame or Portion of Heavenly Light; and the *Cartesians*, a thinking Essence, from which they deduce its Immateriality and Immortality, as well as our Existence, on this general Maxim, *Cogito ergo sum*.

Philosophers are not all agreed as to the Manner wherein the Soul resides in the Body. Some will have it *tota in toto*, and *tota in quâlibet Parte*, i. e. diffused throughout all the Parts of the organical Body, which it influences alike, without any particular Part, being appropriated to its chief Residence; others will have it fixed in its Center, like the *Sun*, from whence it influences all the inferior Parts, like that Planet does all the sublunary Things.

Des Cartes is pleased to place that Center in the *Pineal Glands* of the Brain, where all the Nerves terminate, and from whence, through their Ministry, the *Animal Spirits* are conveyed to all the other Parts; which Sentiment, is in my Opinion, entirely contrary to the Essence, as well as to the Existence of a spiritual Being, which is that of having no *Ubiquity*.

Mess. *Robault*, *Du Hamel*, *Purchot*, &c. are of *Des Cartes's* Opinion, that the Soul resides in the *Pineal Gland*, which *Borri*, a *Milanese* Physician, in a Letter to *Bartoline*, *De Ortu Cerebri*, and *Ufu Medico*, seems to explain in very near the same Manner, by supposing, in the Brain, a certain, very subtil, fragrant Liquor, which circulates through the Nerves, and which is the principal Seat or Residence of the reasonable Soul, adding that the Subtlety and Fineness of the Soul depends on the Temperature of this Liquor, rather than on the Structure of the Brain, to which it is usually ascribed.

This Liquor can be nothing else than the nervous Juice or *Animal Spirits*, formed (in Mr. *Robault's* Opinion) of the most subtil Particles of the Blood carried to the Brain, by the *Aorta Ascendens*, where, by a new Agitation, being entirely freed of their yet less subtil Particles, and reduced into a yet greater Subtlety, or Volatility, are at last irradiated by the spiritual Substance, residing in the Pineal Gland, and from thence circulated through the Nerves to all the Parts of the organical Body; which Spirits being lost or exhausted in their Course, are continually supplied by other new ones flowing from the same Source.

Some of our Mystick Divines have found the Secret (upon what founded I know not) to distinguish the Soul into two principal Parts, viz. the superior and inferior; the superior, which, say they, comprehend the Understanding and the Will; and the inferior, which comprehends Imagination and Sensation.—But how can they divide a spiritual Substance, which is essentially indivisible? How can they even conceive it such? To what purpose such Distinction? Would they have the superior Part know nothing of what passes in the inferior, and so reciprocally? Can they pretend that the Imagination is susceptible of any Ideas which don't reach the Understanding; or that our Understanding can form a Judgment of Things which have not first struck our Imagination? Or can we be sensible of any Thing without the Concomitance of those two Faculties? They give for a Proof of their Distinction, the Example of *Christ* in his Sufferings, whom they suppose to have been happy in the superior Part of his *divine Soul*, while he suffered in the lower Part; so that thereby, his Sufferings which, by an infinite and unlimited Prescience, he had foreseen at the very same Instant he foresaw *Adam's* Fall,

and the indispensable Necessity of a Satisfaction adequate to the Offence, had not been an Act of his Divine Will, but only of his Imagination and sensitive Faculty. But *Christ* complain'd in his Agony of the Bitterness of his Cup; and that Complaint could not be an Act of his Imagination only, or a *motus primo primus*, since that Complaint is accompanied with this Act of his Will, *If it be possible make that Cup pass from me*, and with this other, *thy Will be done*; which all three were the Act of his *Divine Soul*, as hypostatically united to the human Nature; he speaks on this Occasion like a Man, because he was to suffer like a Man; but his human Acts don't disturb, in the least, that eternal Happiness he enjoy'd like a *God*; to think otherwise is to suppose *Christ* subject to those Imperfections and Weaknesses incompatible with his *Hypostasis*, and which is an Error condemned in *Molinos*, who, by dividing the *Soul* into two different Parts, persuaded his Partisans, (called afterwards *Quietists*) that the superior Part of the Soul could keep itself untainted and undefiled, while the inferior was plunged in Luxury, provided that superior Part could retain to itself a Consciousness of its Innocency.

M. *de Fenelon*, Archbishop of *Cambray*, in his *Maximes des Saints*, had asserted that Opinion of *Molinos*, for which he was censured at *Rome*, and which himself condemned afterwards.

Tho' the *Soul* is indivisible, it has nevertheless several Faculties, the principal whereof are the *Understanding* and the *Will*.

The UNDERSTANDING, according to the *Peripateticks*, is a Faculty of a reasonable Soul, conversant about intelligible Things, considered as intelligible, which they divide into active and passive *Understanding*.

Active Understanding is, in their Opinion, that Faculty, whereby the *Soul*, from the Presence of Phantasms or Appearances, frames to itself *Species* and *Images* of intelligible Things.

Passive Understanding, is that which receiving the Phantasms form'd by the Active Understanding, breaks forth into an actual Knowledge, or rather reduces into Practice the Perceptions of the Active Understanding.

The *Cartesians* define the *Understanding*, that Faculty wherewith the Mind conversing with itself, evidently knows what is true in any Thing not exceeding its Capacity.

Nil est in intellectu quod prius non fuerit in sensu, Nothing is in the *Understanding*, which has not been first the Object of our Senses, is the favourite Axiom of our modern Philosophers; who thereby attribute two Offices to the *Understanding*, viz. Perception and Judgment, whereas the *Cartesians* know but one, viz. Perception.

WILL, *Voluntas*, is usually defined a Faculty of the Mind, whereby it embraces or rejects any Thing represented to it, as Good or Evil, by the Judgment.

It is also often taken for the *Mind* itself, considered as embracing or refusing; under the Supposition, that as the *Understanding* is nothing else but the *Soul* consider'd as *Perceiving*; so the *Will* is nothing else but the *Soul* consider'd as *Willing*.

Father *Malbranche* believes the *Will* to be to the *Soul*, what Motion is to the Body; and argues, that as the Author of Nature is the universal Cause of all the Motions in Matter, so he is of all the Inclinations of the Mind; and that as all Motions are direct, unless their Course be diverted and changed by some foreign Cause; so all Inclinations are right, and could have no other End but the Enjoyment of Truth and Goodness, were there not some foreign Cause to determine the natural Impression to evil Ends.

By this Definition Father *Malbranche* seems to confine the *Will* within very narrow Limits, and would almost insinuate, that the *Mind* has no Power of itself, or at least but a very weak one, to order the Consideration of any Idea, or the forbearing to

consider it, since, in that *meditating Philosopher's* Opinion, it is directed in its *Volition*, or by a natural and interior Cause, or by an external and foreign one, which Direction, in that Sense, could be supposed rather a Kind of Necessity than a simple Direction; which we will examine more strictly in our Treatise of *Metaphysick*, under the Letter M; and we shall be thereby more capable to judge if Father *Malbranche's* *Metaphysical Meditations* smell of *Jansenism* or not.

Mr. *Locke* defines the *Will*, a Faculty which the Soul has of beginning or forbearing, continuing or ending several Actions of the Mind, and Motions of the Body, barely by a Thought or Preference of the Mind, ordering, or as it were, commanding the doing, or not doing, such a particular Action.

In this Mr. *Locke* differs widely from Father *Malbranche*, since he attributes to the *Will* almost an absolute Power of determining itself in its Volition, without the Concurrence of familiar or foreign Causes, otherwise than by their being the occasional Causes of our Perceptions by the *Understanding*.

Memory, *Imagination*, *Liberty* and *Sensation*, are also Faculties of the Soul.

MEMORY is a Faculty whereby the *Mind* retains, or recollects the simple Ideas or Images of Things we have seen, imagined, understood, &c.

Dr. *Hook* in an *Essay towards a mechanical Account of Memory*, supposes it to consist in a Stock of Ideas or Images, form'd occasionally by the Mind, out of the fine Parts of the Brain, and disposed or laid by in Order.

Des Cartes is of Opinion, that the *Animal Spirits*, exciting a Motion in the most delicate Fibres of the Brain, leave a Kind of Traces, which occasion our Remembrance; hence it happens that passing several Times over the same Things, the Spirits becoming accustom'd to the same Passages, leave them open, and so make way without any Force or Labour; and in this consists the Ease with which we recollect such Ideas.

Father *Malbranche's* "presupposing that all our different Perceptions are owing to Changes happening in the Fibres of the principal Parts of the Brain, wherein the *Soul* more immediately resides; pretends that the Nature of Memory is obvious; for as the Leaves of a Tree that have been folded for some time in a certain Manner, preserve a Facility or Disposition to be folded again in the same Manner; so the Fibres of the Brain having once received certain Impressions by the Course of the *Animal Spirits*, and by the Action of Objects, preserve, for some time, a Facility to receive the same Disposition. Now, says he, it is in this Facility that the Memory consists; for we think of the same Things when the Brain receives the same Dispositions.

"Further, as the *Animal Spirits* act sometimes more briskly, and sometimes more languidly on the Substance of the Brain; and as sensible Objects make deeper and more lasting Impressions than the Imagination alone; it is easy on this Scheme to conceive, why we do not remember all Things alike: Why a Thing, for Instance, seen twice, is represented more vividly to the *Mind*, than another seen but once: Why Things that have been seen, are usually remembered more distinctly, than those that have been only imagined, &c.

"Old Men are defective in Memory, and cannot learn any Thing without much Difficulty, because they want *Animal Spirits* to make new Traces, and because the Fibres of the Brain are become too hard to receive, or too moist to retain such Impressions. For the same Reason, those who learn with the greatest Ease, forget the soonest; in regard when the Fibres are soft and flexible, Objects make a slight Impression, which the continual Course of *Animal Spirits* easily wears off; on the contrary, the Fibres of those who learn slow-

ly, being less flexible, and less subject to be shaken the Traces are more deeply engraven and last the longer."

These two *Hypotheses* of *Des Cartes* and *Malbranche* appear to me defective in several Particulars.—

That of *Des Cartes*, that our *Memory* is the Effect of the Motion excited in the Fibres of the Brain, by the Circulation of the *Animal Spirits*, don't answer to all the different *Phænomena* of the *Memory*; since the Dilatation and Impression, made in those Fibres by the Spirits after the first *Perception*, which he supposes the first Principle of the *Memory*, should presuppose also those Fibres susceptible of an Irradiation, or from the *Soul* itself, or from those same Spirits which circulate through them; if from the *Soul*, why not immediately, since the being placed nearer its principal Seat, they can receive its Influences rather sooner than the *Animal Spirits*, whose Origin is from somewhere else, which are only as itinerant in the Brain, and calculated only for to animate the inferior Parts; and if by the *Animal Spirits*, how, and in what Manner? Is it because they irradiate the Fibres by their Contact, or have those Fibres any Pores appropriated for the Reception of those Spirits? If by their simple Contact or *Effluvia*, as when Iron is touched by the Magnet, what need have those Spirits of their perpetual Rotation to refresh the Memory, and renew the Ideas which had lain dormant, since the same can be effected by our Imagination, directing those *Effluvia* anew; and if it is done by those *Spirits* being lodged in the Pores of the Fibres, how can the Dilatation be of any Service to them in their Return, since they have not changed Place?

There is, in my Opinion, a Sort of Contradiction in *Malbranche's* *Hypothesis*, if *Memory* is the Effect of Traces left in the Fibres of the Brain by the *Animal Spirits*, and old Men are defective in *Memory*, for want of *Animal Spirits* to make new Traces, *Memory* must have another Origin, from whence those *Spirits* must borrow the Faculty of making those new Traces; for if the first Traces made by the first *Spirits* are obliterated, the Impression made on those *Spirits* was not *Memory* itself, else by the Obliteration of those Traces the *Memory* must be lost. But perhaps those same first *Spirits* come back to renew those Traces, which cannot be *Malbranche's* Opinion, since he pretends that old Men want *Animal Spirits* to make new Traces. Besides, how can we answer, or rather is it not contrary to the general Sentiment of *Anatomists*, that *Spirits* exhausted, or perhaps lost or evaporated in their Circulation, could preserve Strength enough, or that the first Impregnation should be of such Efficacy, as to render them capable of making new Traces of the same Objects, which could make a second, third, fourth, &c. Representation of them as vivid as the first.

I am rather of Opinion (and this is my own *Hypothesis*) that there are *Animal Spirits* of different Kinds, according to their different Destination, and differently irradiated; some for a single Perception of Things, some for the Imagination, some for Sensation, *Memory*, &c. that the Irradiation is more or less strong, as the Order, Arrangement, or Situation of their Pores is more or less disposed to receive it. That those assigned to *Memory*, being of an oblique Figure, and their Particles concatenated together in the Form of a *Ret*, when stricken by the first Impression at the Appearance of an Object, and thereby put in Motion, or direct themselves to receive in their Interstice all the Impressions which the Understanding forms of that Object, to which Direction they are kept fix'd by the Atmosphere which subsists between them and the Imagination, proceeding from the continual *Effluvia* flowing from each other, and which last till dissipated by the Perception of a new Object, they are forced to direct themselves otherwise.

By this *Hypothesis* all the different *Phænomena* of *Memory* may be easily accounted for; since in this Case the *Memory* is like a Needle directed by the Magnet,

and the *Imagination* its Magnet or Pole; when the *Imagination* lets flow the *Effluvia* which have any Analogy with those of one Side of the *Memory*, the *Memory* is directed on that Side, and the Representation of the Object, which that Side was directed for, is renewed.—By these Means there can be no Confusion in the Representation of Objects, since each Object has its proper Side in the *Memory* assigned to it; nor can those Spirits be exhausted by their Rotation, since besides being always kept by their Magnet in their proper Situation, they are also continually strengthened by new Irradiations from the *Soul*, till the *Soul* itself being unbecillitated in its Functions, by Age or other Accidents, and its Irradiations becoming less frequent, the *Memory* is thereby weaken'd, as well as all the other Faculties.

Seneca says of himself, that by the mere Effort of his natural *Memory*, he was able to repeat two thousand Words upon once hearing them, each in its Order; though they had no Dependence or Connection on each other. After which he mentions a Friend of his, *Portius Latro*, who retain'd in his *Memory* all the Declamations he had ever spoke, and never had his *Memory* fail him, even in a single Word.—He also mentions *Cynæas*, an Ambassador to the *Romans* from King *Pyrrhus*, who in one Day had so well learn'd the Names of his Spectators, that the next he saluted the whole Senate, and all the Populace assembled, each by his Name. *Pliny* says (though *Pliny* is a great Liar, and his Testimony in any thing whatever not much to be depended upon) that *Cyrus* knew every Soldier in his Army by Name; and *L. Scipio* all the People of *Rome*. *Carneades*, when required, would repeat any Volume found in the Libraries, as readily as if he were reading.—*Dr. Wallis* tells us, that without the Assistance of Pen and Ink, or any thing equivalent, he was able, in the Dark, by mere Force of *Memory* to perform arithmetical Operations to forty Places; particularly that in *February* 167½, at the Request of a Foreigner (by Night in Bed) he propos'd to himself a Number of fifty-three Places, and found its Square Root to twenty-seven Places; and without ever writing down the Number, dictat'd it from its *Memory*, at his next Visit, twenty Days afterwards.

Myself have been blessed with so happy a Memory, that at sixteen Years old, I could recite Word for Word a Sermon of a whole Hour preaching from once hearing it, and have done the same of the two Orations of *Cicero*, for and against *Diotarus*, for once reading them, though my Memory has often failed me in Poetry, for which I have not the least Taste, but never so in Prose, let it be what it will; which confirms me in the Opinion, that *Memory* is very much under the Direction of our Understanding.

IMAGINATION is a Faculty of the *Soul*, by which it conceives or forms Ideas of Things by Means of Impressions made on the *Animal Spirits*, assigned to that Faculty.

Willis places the *Imagination* in the *Corpus Collosum*; *Fernelius* in the *Pia Mater*; *Des Cartes* in the Pineal Gland, which he makes the chief Residence of the *Soul*; and *Malbranche* in that Part of the Brain where the Nerves terminate, pretending that whenever there is any Alteration in that Part to change the Order of its Fibres, there also happens a new Perception in the *Soul*, and she finds something new, either by way of Sensation or *Imagination*.—So that the Faculty of *Imagining* or *Imagination*, only consists in the Power which the *Soul* has of forming Images of Objects, by producing a Change in the Fibres of that Part of the Brain, which may be called the principal Part, because it corresponds to all the Parts of our Body, and is the Place where the *Soul* immediately resides.—It matters not which that Part is, it suffices that there is some such Part, and consequently in that Philosopher's Opinion, we are to be as uncertain of the Place and Situation of the Fibres assign'd to that Faculty, *Imagination*, as to

that where the *Soul* makes its chief Residence, which in my Sentiment, is very problematick.

But as the *Imagination* has a Power to form to itself Images of Objects, which have no real Existence, it is better said, by the Velocity or Quickness of the *Animal Spirits* assigned to that Faculty, which when they flow with more Impetuosity, and in greater Abundance, from the Place they are formed in, and the quicker they are in their Action, the more our *Soul* is affected with the Object imagined. The less those Spirits are agitated, and from their Slowness proceeds the Slowness of the *Imagination*. Though the Images of the Objects thus received are not so soon defaced in our *Soul*, as those of a quicker *Imagination*, which are obliged to give Place to the various Objects, which continually succeed each other.

SENSATION is the Act of perceiving external Objects by means of the Organs of Sense.

If we be pleas'd to admit of this Axiom of a modern Philosophy, That *nihil est intellectu, quod prius non fuerit in sensu*, we'll soon conceive the Manner how Sensation is effected; since we'll suppose all the Organs to consist of little Filaments or Nerves, which having their Origin in the Middle of the Brain, are diffus'd thence throughout all the Members which have any Sense, and terminate in the exterior Parts of the Body; that when we are awake, one End of these Nerves cannot be agitated or shaken without shaking the other; because they are always a little stretched, as 'tis evident in the Chords of a Violin, which when stretched, one End thereof cannot be touched, without the other End being sensible of the same Motion, or rather the whole Chord is seized in an Instant by a certain Continuity with that Motion.

The Nerves may be agitated two Ways, either at the End out of the Brain, or at that in the Brain.—If they be agitated from without by the Action of Objects, and their Agitation be not communicated as far as the Brain, as frequently happens in Sleep, when the Nerves are in a State of Relaxation, the *Soul* does not then receive any new Sensation.—But if the Nerves happen to be agitated in the Brain by the Flux of the *Animal Spirits*, or any other Cause, the *Soul* perceives something, though the Parts of those Nerves that are out of the Brain, diffus'd through the several Parts of the Body remain at perfect Rest. As likewise is frequently the Case in Sleep, when we fancy we see Objects which have not been communicated to the *Soul* by Means of the Organs of our Senses.

We also know by Experience, that we may sometimes feel Pain in Parts of the Body that have been entirely cut off, by Reason of the Continuity which subsists throughout the whole Body of the Organ from one End to the other, and the perpetual Agitation of the *Animal Spirits*, which by the perfect Analogy between those that remain in the Brain, and those left in the Part extirpated, continues the Sensation, as long as the Atmosphere, form'd by the *Effluvia* flowing from both continues, which is as long as the *Soul*, always attentive to the Preservation of all the Parts of the Body, finds that it is in vain to attempt the supplying the Part extirpated with new Spirits, towards continuing to render it sensible.

We must observe here, that there is a vast Difference between the Sensation which causes Pain, and that which procures some Pleasure or Titillation; Pain proceeds from a preternatural Separation or Extension of the Fibres of the Organs, which produces the same Effect at their Origin in the Brain; or from some Interruption in the regular Motion of the *Animal Spirits* diffus'd throughout those Organs, which consequently causes a Suffocation, or a Superabundance at the Place of their Formation; but while those Fibres continue in their natural State, and the *Animal Spirits* by a gentle Stream glide insensibly through, without the least Interruption from foreign or heterogeneous Bodies, the *Soul* being thereby informed

informed of the good State of Health of those Parts, is susceptible of that Titillation, which causes Pleasure.—Not that I would thereby insinuate that the Soul has a particular Residence in the Brain, but in my Opinion its Irradiations are stronger in that Part, than in any other of the organical Body; since it remains uncontroverted, that in the Brain, and no where else, are formed the *Animal Spirits*, employed by the Soul in all the different Operations of its Faculties; that *Sensatio fit in Cerebro*, Sensation is effected in the Brain, *i. e.* when the Body suffers in any of its Parts, it is not those Parts affected which suffers, but that Part in the Brain where the Nerves of that Part have their *Origination*; the Soul is in the Brain, what the Sun is under the *Equinoctial Line*, where it darts its Rays with greater Strength than at any other Part of the World; not that the *Equinoctial* is appointed for the Sun's chief Residence, exclusively of all the other Parts of the Globe, but because its Beams strike there, in less oblique, and more perpendicular Lines; likewise the Irradiations of the Soul are more powerful in the Brain than in any other Part of the organical Body; not that the famous *Pineal Glands* of Des Cartes, or the *Corpora Striata*, or the Ventricles of the Brain, are appointed for its chief Residence, but because the most subtil Particles of the *Animal's* Substance, and the more proper for its Operations are there separated; whereas in all the other organical Parts, the Heart not excepted, those Particles are wrapp'd in so many heterogeneous Corpuscles, that the strongest and most powerful Irradiation of the Soul could but render their Motions languid, and thereby expose the rational Faculties to be often interrupted in their Operations.

From the first *Perception* of the Objects, from the Strength of our *Imagination*, which forms to itself *Ideas* of those Objects, and from the just *Œconomy* of our *Understanding*, which directs those *Ideas* proceeds the reducing them into Practice, so as to form a Judgment of them, which is effected by another Faculty of the Soul, in which all the Operations of the other Faculties come to centre themselves, which Faculty we call REASON.

Chauvin has defined Reason, an innate Notion, or *Idea*, further diffused, and arising from a continued Attention.

Mr. Lock observes, that Reason comprehends two distinct Faculties of the Mind, *viz.* *Sagacity*, whereby it finds intermediate *Ideas*, and *Illation*; whereby it so orders and disposes of them, as to discover what Connection there is in each Link of the Chain, whereby the Extremes are held together, and thereby as it were, draws into View the Truth sought for. *Illation*, or Inference, consists in nothing but the Perception of the Connection there is between the *Ideas*, in each Step of the Deduction, whereby the Mind comes to see, either the certain Agreement, or Disagreement of any two *Ideas*; as in *Demonstration*, in which it arrives at Knowledge; or their probable Connection, in which it gives or with-holds its Assent; as in *Opinion*.

This Reasoning of Mr. Lock is rather too *Metaphysical* for this Place, and far above a common Apprehension; therefore, I'll rather choose to say that Reason is the *Master-Faculty*, (if I may use that Expression) which gives the finishing Stroke to all the other Operations, in order to make them a perfect, and accomplished Work. That it elucidates all the other Faculties, whose Operations (without the Intervention of Reason) would always be entirely hidden from us. That by both its attractive and repulsive Faculties, it draws to itself all the *Animal Spirits*, directed by the other Faculties of the Soul, in their different Operations; and by a third, peculiar to itself, it orders those same *Spirits*, so as to be capable to expel those which have been falsely, or imperfectly directed, and retain the others which can help its Sagacity in its Determinations and Consequences.—From those noble Operations results that excellent Quality which exalts the Soul above all other created Beings, and

that essential Difference which distinguishes *Man* from all other *Animals*.

RATIONALITY; besides a reasonable Soul, which raises *Man* above all other created Beings, he has a sensitive one, in common with the other *Animals*, which both have a vegetative one in common with the *Plants*, not that those Souls are essentially and substantially divided from each other, so as the one to be capable of subsisting without the other, for they are indivisible in the same Subject; but because that very same Soul, which is capable of Rationality in *Man*, is also capable of Sensation and Vegetation, though the sensitive Soul in the Brutes is not *rational*, nor the Vegetative in the *Plants sensitive*.

IRRATIONAL ANIMAL is, also, an organical Body, animated with a Soul, which has its Origin, or Result as well from the just Symmetry of its Organs, as from the Formation and the uninterrupted Course of the *Animal Spirits*, but without *special Irradiation*.—In that want of Irradiation they essentially differ from *Man*; and in their sensitive Faculty from the *Vegetables*.

The *Cartesians*, allowing nothing in *Brutes*, but what's material, strip them of all the Properties and Faculties of the human Soul; they deny absolutely their being subject to any of the Passions which affect the human Soul, as Pain, Pleasure, Love, Hate, &c. That if all the Motions of *Brutes* plainly demonstrate an Intelligence, if all their Actions plainly evidence an Understanding, as Fear, Caution, Love for their Young, admirable Sagacity, both for their own Preservation, and that of their Species, that Intelligence does not reside in them, and is as distinct from the Beasts as that which ranged the Wheels of the Watch is distinct from the Watch itself; and if they act in such Manner as shews Understanding, it is because God having made them to preserve them, has formed their Bodies, so as to avoid whatever might hurt them mechanically.—That all those Functions, which some imagine the Effect of a sensitive Soul, or of the Configuration of the Matter, subtilized, framed, ranged, and moved in a certain Order, has no other Cause but the just Symmetry of the Parts, as disposed by the divine Architect.—That the apparent Disorders happening in some Parts of that excellent Mechanism, and attributed to a sensitive Faculty, are only the Effects of the accidental Irregularity of its Motions, or the adventitious and violent Pulsation of some heterogeneous Bodies.—That if those different Motions were in Reality the Operations of a sensitive Soul; they see no Reason why the Vegetables should be denied that Soul, as regular in their Motions as the *Animals*, the Radicle of a Seed turning downwards, and the Stem upwards, whatever Situation the Seed is sown in; the young Plant knitting from Space to Space to strengthen it, putting forth its Prickles, &c.

The *Peripateticks* are of a contrary Sentiment, and invest the *Brutes* with the greatest Part of the Properties and Faculties of the Soul; pretending that Beasts are capable of Sensation, and Passion; that they may feel and perceive by Means of the *Animal Spirits*, which is a Matter subtilized, framed, moved, and ranged in a certain Manner, as to render them capable of exercising those Faculties.

I see no Difference between this Soul, attributed to the *Brutes* by the *Peripateticks*, and what we call *Instinct*, which is a natural Disposition or Sagacity, wherewith they are endued; by Virtue whereof they are enabled to provide for themselves, know what is good for them, and are determined to preserve and propagate their Species.

Brutes, besides their sensitive and vegetative Soul, consist also, like *Man*, of solid and firm Parts, as Flesh, Bones, Membranes, &c. of Fluids, as Blood, Juices, &c. and of Fat, which may be reckoned an intermediate Kind.

The solid Parts are mere Earth, bound together by some oily Humour, and accordingly are reducible by Fire into such Earth again.

Thus

Thus a Bone being perfectly purged of all its Moisture by Fire, becomes a perfect Earth, which the least Force will crumble into Dust; but immersing the same Bone in Water or Oil, it becomes firm again, and more so in Oil than Water, as is plainly seen in *Cupels*, made of calcined Bones, and which will sustain the greatest Degree of Fire.

The *fluid Parts* of *Animals*, are the cruder, as they are less distant from the *Lacteals*, and absorbent Vessels.——Thus *Chyle* is little else but a vegetable Juice; but in its farther Progress, gradually lays aside its vegetable Quality, till in its Progress through the different Vessels, wherein it receives its different Preparations, in Order for its greater Perfection, it becomes at last an *Animal Juice*, from whence all other Humours proceed, and are separated.

Animal Substances contain neither acid nor fixed Salts, contrary to the Substances of the Vegetables, from which both acid and fixed Salt can be extracted. Though some *Artists* pretend to have extracted by Lixivation, a small Quantity of fixed Salt, out of the *Caput Mortuum*, left in the Alembick, after the Distillation of the *Viper*.

ANIMALS are ordinarily divided into *terrestrial*, *aquatick*, *volatile*, *amphibious* Insects, &c.

Terrestrial Animals, are either *Quadrupedes* or *Reptiles*.

QUADRUPEDES are divided by Mr. Ray, into those which are *hoofed*, *ungulata*, and *clawed*, or *digitate*, *unguiculata*.

Hoofed QUADRUPEDES, are either whole-hoofed, *Solidipeda*, as the Horse, Ass, the *Onager* or wild Ass; the Mule, and the *Zebra* of *Africa*, or the fine *striped Indian* or *African Ass*, almost like a Mule in Form and Stature; or *cloven footed*, and these again subdivided into,

Ruminant, that is such as chew the Cud; and these either have hollow and perpetual Horns, as the Bull, Sheep and Goat-kind; or deciduous Horns, as the Hart and Deer-kind, which usually shed their Horns annually.

Of the Bull-kind are the common *Bos* or Bullock, of which the Male is *Taurus*, Bull; the Female, *Vacca*, Cow; the *German Urus*, *Aurocks*; the *Bison*; the *Bonafus*; the *Bubulus* or *Buffalo*, &c.

Of the Sheep-kind, the Arabian *Ovis Laticauda*, such as are seen in the Isle of *Formosa*, and at *Madagascar* in the *East Indies*, whose Tail is sometimes of forty or fifty Pounds Weight; the *Ovis Strepliceros Cretica Bellonii*, the *Ovis Africana*, with short Hairs instead of Wool; the *Ovis Guineensis* or *Angolensis* of *Marcgrave*, besides the common Sort.

Of the Goat-kind, the *Ibex* or German *Steinbock*, found in the Tops of the *Alps*; the *Rupi Capra*, French *Chamois*, or German *Goms*; the *Gazella Africana* or Antelope; the *Gazella Indica*; the *Capra Silvestris Africana Grimmerii*; the *Capra Mambrina*; the *Buselaphus* or *Moschelaphus Caii*, in *Gesner*; the *Tragelaphus Caii*, in *Gesner*, &c.

Of the Hart or Deer-kind, the *Cervus* or red Deer; *Alce* or the Elk; the *Cervus Palmatus* or Fallow Deer; *Rangifer* or Rain Deer; the *Caprea Groenlandica*, &c.

Of the *Cloven-footed*, into two Parts only, and which does not chew the Cud, there's none but a Hog and Swine-kind: Under this Head, besides the common Kind, are reckoned the wild Boar, *Sanglier*; the *Porcus Guineensis Marcgravii*; the *Porcus Indicus*, called *Barbirouffa*; the *Trojaca*, or *Aper Mexicanus Moschiferus*, of Dr. *Tyson*, called by *Marcgrave*, *Trojaca Conigoara*, and by *Acosta* and some others, *Zaino*.

There are some *Quadrupeds*, whose Hoof is cloven into four Divisions; and these seem to be not *ruminant*; as the *Rhinoceros*, the *Hippopotamus*; the *Tapirerete* of *Brasil*; the *Capa bara* of *Brasil*, and the Animal *Moschiferum*.

Of the *clawed* or *digitated Quadrupeds*, there are first, a Sort whose Claws are not divided or separated, but adhering to one another, covered with one com-

mon Skin, but with obtuse Nails, sticking out round the Margin of the Foot; as the *Elephant*, which is anomalous, and not clearly referable to this Kind, or to that of *cloven-footed Quadrupeds*.

The *Camel* has only two Claws, has no Horns, though they have four Stomachs, and ruminate like those of the horned Ruminant-kind, and are nevertheless, a second Species of the *Digitated-kind*.——There are two Sorts of *Camels* or *Dromedaries*, one having but one Bunch on the Back, and the other two.——The *Peruvian Glame*, the *Pacos*, the *Ovis Indica*, or *Peruviana Vulgo*; all belong to this Kind.

All the *Animals* whose Foot is divided into many Claws, with broad Nails on them, as the *Ape* and *Monkey-kind*, is a third Species of the *Ungulated*.——Of these, some have no Tails, and are called *Simie*, or Apes: Others have Tails, and are called *Monkeys*; and such as have either long or short Tails, if they are of a larger Size, are called *Baboons*. There are great Number or Varieties of this Species of *Quadrupeds*, as the *Homo Silvestris* of Dr. *Tyson*; the *Guarita* of *Brasil*, *Marcgravii*, the *Cagui*, the *Cay*, the *Caitaia*, of the same Country, &c.

Those which have many Claws covered at the End, with crooked and sharp-pointed like the Talons of Hawks, and not with broad flat Nails, like Monkeys or Apes, are a fourth Species of the *Ungulated-kind*.——Of these there are two Sorts, a greater, which either have a short, round Head, as the Cat-kind; or a lesser Sort, having a long, slender Body, with very short legs, as the Weasel, or Vermin-kind.——The Hare-kind is a Species of *Quadrupeds*, which have only two large remarkable Teeth in each Jaw, and live upon Herbs.

The *Lion*, the *Tiger*, the *Pardus*, the *Panther*, the *Leopard*, the *Lynx*, the *Cat-a-mountain*, the Common Cat, and the *Bear*, are *Quadrupeds*, of the Cat-kind.

Besides the common *Dog*, of which Kind are the *Mastiff*, the *Greyhound*, the *Irish Greyhound*, the *Spaniel* for Land or Water, the *Tumbler*, the *Lap-dog*, the *Shock*, the *House-Dog*, &c. &c. The *Wolf*, and the *Jackall*, are also of the *Dog-kind*; as well as the *Fox*; the *Animal Zibetium*, corruptly called *Civet Cat*, the *Badger*, *Grey* or *Pate*, the *Otter*, the *Sea Calf* or *Seal*, the *Morse* or *Sea Horse*, the *Sea Cow*, &c.

The common *Weasel*, in *Yorkshire* called *Foumart* or *Fitcher*, the *Quel*, or *Quirpele*; the *Mustela Ermin* or *Stoat*, if white; the *Ferret*, the *Pole Cat*, the *Marten* or *Martlet*, the *Sable*, &c. are of the *Vermin-kind* of *Quadrupeds*.

The common *Hare*, the *Rabbit* or *Coney*, the *Porcupine*, the *Castor*, *Fiber*, or the *Beaver*, the *Squirrel*, the *Virginian*, *Zeylandic*, *Barbary*, and *American Flying Squirrel*, the common *Rat* and *Mouse*, the *Water Rat*, the *Musk Rat*, the *Dormouse* or *Sleeper*, the *Guinea Pig*, &c. are *Quadrupeds* of the *Hare-kind*.

There are six Sorts of anomalous *Quadrupeds*, or of *Quadrupeds* that deviate from the common Form of *Animals* of the same Kind.

1. *Animals* with their Feet divided into many Claws and Toes, have a longish Snout, and Teeth; as the *Hedge-hog*, the *Mole*, the *Warp*, or *Mole-warp*, *Shrew*, *Hardyshrew*, *Shrew-mouse*, &c.

2. Those with their Feet divided, also, into many Claws and Toes, have a longish Snout, but no Teeth; as the great *Ant-bear*, the lesser *Ant-bear* of *Marcgrave*, the *Tamandua-guacu* of *Brasil*, &c.

3. The *Bat-kind*, or *Plitter-mice*, of which there are several Sizes and different Forms, and which are *Anomalous flying Quadrupeds*, with a shorter Snout, and their Feet divided.

4. The *Sloth* or *Sluggard* is an anomalous *Animal*, which has but three Claws on each Foot.

5. The *Frog* or *Frosh*, the *Small Tree* or *Green Frog*, the *Toad*, the *Tortoise* of Land or Water, are *viviparous* and *sanguinous Quadrupeds*, breathing with Lungs but have but one Ventricle in the Heart.

6. The *Crocodile*, the common *Eel*, *Swift* or *Newt*; the

the *Green Lizard*, the *Neapolitan Tarantula*, the *Swift* or *Spotted Lizard*, the *Water Eft*, and the *Cameleon* or *Camilion*, are *oviparous Quadrupeds*, with a long Tail, stretched out Horizontally.

REPTILES (from the Latin *Rept*, I creep) are another Species of *terrestrial Animals*, and a Kind of *Animals*, which instead of Feet rest on one Part of the Body, while they advance forwards with the rest, as *Vipers*, *Snakes*, *Earth Worms*, &c.

The creeping of *Serpents* is effected by Part of the Body, being applied on rough Ground, and the Rest ejaculated and shot from it; which being set on the Ground in its Turn, bring the other after it.—The Spine of the Back, variously wreathed, has the same Effect in leaping as the Joints of the Feet in other *Animals*; they making their Leaps by means of Muscles that extend the *Plicæ* or Folds.

Mr. *Derham* says, that the Body of the Earth-worm (whose Creeping is somewhat different from that of the *Serpent*) is only one continued spiral Muscle, the orbicular Fibres whereof by being contracted, render each Ring narrower, and longer than before; by which Means it is enabled to force its Passage into the Earth.

The **AQUATIC Animals** are all those that live in Water, as Fishes of all Kind.

FISHES are distinguished into Salt Water Fish, *Pisces Marini*, as the *Whale*, *Herring*, *Mackarel*, *Sole*, *Skate*, *Turbot*, &c. &c. and fresh-water Fish, *Pisces Fluviatiles*, as the *Pike*, *Trout*, *Carp*, *Tench*, &c. to which may be added, *Salmons*, *Shad-fish*, which abide indifferently in fresh Water or Salt.

M. *Willoughby* distinguishes Fishes into *Cetaceous*, *Cartilaginous* and *Spinous*.

The **CETACEOUS** (from the Latin *Cetus*, Whale,) have Lungs, and breathe like *Quadrupeds*, copulate like them, conceive and bring forth their Young alive, which they afterwards suckle with their Milk, as the *Whale*, the *Dolphin*, *Phocæna*, the *Porpus*, &c.

N. B. The Horn, usually called *Unicorn's-Horn*, is the Tooth of an *Acetous Fish*, in the *Icy Sea*, called *Narval*.

The cartilaginous Sorts (thus called for their having their Bones of a cartilaginous Substance) are produced from large Eggs, like Birds, which are also excluded the Womb, like those of Birds; and these are divided into long Cartilaginous and plain Cartilaginous.

The long Cartilaginous, of which we have Abundance on our Coasts, are the *white Shark*, the *blue Shark*, *Canis Galeus Rondeletii*, called a *Tape* in *Cornwall*; the *Prickled-Dog*, or *Hound-Fish*, the *smooth* or *unprickled Hound-Fish*; the *rough Hound*, called in *Cornwall*, the *Bounce*; the lesser *Hound-Fish*, or *Mor-gay*, &c.

The plain Cartilaginous, which also visit our Coasts, are the *Skate* or *Flare*, the *Thorn-back*, the *white Horse*; the *Angel*, or *Monk-Fish*, the *Toad-Fish*, or *Sea-Devil*, &c.

SPINOUS FISHES (from their having *Spinæ* up and down in their Flesh to strengthen it) are also *Oviparous*, but their Eggs are smaller; and these are also divided into long Spinous and plain Spinous.

The plain Spinous, of which we have Abundance, are the *Eel-Kind*, viz. the *Lamprey*, or *Lamprey-Eel*; the *Lampern*; the common *Eel*; the *Conger*, or *Sea-Eel*; the *Sand-Eel*, or *Launce*; the *Butter-Fish*; the *Sea-Loach*, or *Whistle-Fish*; the *Eel-Pout*, or *Turbou*; the *Wolf-Fish*, or *Sea-Wolf*; the *Sea-Lark*, called in *Cornwall* *Mulgranock* and *Bulkard*; the crested *Sea-Lark*; the *Bull's-Head*, or *Miller's-Thumb*; the *Dutch Pot's-Hog*; the *Cornish Boys* calls it *Father Laffer*.

The plain Spinous are the *Turbot* or *Brett*; the *Lug-Alese*; the *Plaise*, the *Flounder*, *Fluke*, or *Butt*, the *holy Butt*; the *Sole*, &c.

There are three different Sorts of the none-spinous Kind of Fishes; some with only one soft and prickly

Fin on their Back; some with two, and others with three.

Those with only one Fin on their Back, are the *Herring*, the *Pilchard*, the *Anchovy*, the *Shad*, the *Sprat* or *Sparling*, which is nothing else but the *Fœtus* of a *Herring*; the *Garnish*, or *Horn-Fish*, the *Sturgeon*, the *Pike*, or *Pikrel*, the *Carp*, the *Bream* or *Bruma*, the *Tench*, the *Rudd*, *Oerve*, or *Nexsling*, the *Chubb* or *Cbevin*, the *Barbel*, the *Dace* or *Dare*, the *Roach*, *Bleak* or *Bley*, the *Gudgeon*, the *Loch*, the *Pink*, or *Minnow*, &c.

Those with two Fins on their Back, are the *Hake*, the *Ling*, the *Tunny*, or *Spanish Mackrel*, the *Mackrel*; the *Gragling* or *Umber*, the *Guinnad*, the *Shelly*, the *Salmon*, the *Samlet* or *Branlin*, the *Gray*, the *Salmon-Trout*, the *Scurf* or *Bull-Trout*, the *Red Chart* or *Welch Torgoch*, the *Guilt*, or *guilt Charr*, the *Smelt*, the *Rock-Fish*, or *Sea-Gudgeon*, the *Lump*, or *Sea-Owl*, &c.

Those with three unprickly soft Fins on their Back, are the *Cod-Fish*, or *Caling*, the *Whiting Pollack*, the *Coal-Fish*, or *Rawling Pollack*, the *Bib*, or *Blinds*, the *Haddock*, the *Whiting*, &c.

There are Fishes called of the *aculate Kind*, with only one Fin on their Back, whose *Radii* are some prickly and some soft; such are the *Guilt-Head*, or *Guilt-Poll*, the *Bream*, the *Old Wife*, or *Wrap*, the *Ruff*, the common *Prickle-Back*, or *Sharpling*, or *Banstickle*, the lesser *Prickle-Back*, &c.

Others with two Fins on their Back, whose *Radii* are all Prickly, as the *Mullet*, the *Grey Gurnard*, the *Tub-Fish*, the *Red Gurnard*, or *Rotchet*, the *Piper*, the *Sur-Mullet*, the *Spider*, the *Scad*, the *Perch*, the *Dory*, or *Doree*, &c.

Willoughby has also divided Fishes into such as breathe with Lungs, and such as breathe with Gills; and again subdivided such as breathe with Gills into *Viviparous* and *Oviparous*.

He divides the *Viviparous* that breathe with Gills into long and broad Fishes, the long are the *Sharks*, and *Dog-Fish*; and the broad, the *Pastinaca*, *Raja*, &c.

He divides also the *oviparous Kind*, that breathe with Gills, into *Flat Fishes*, and into those that swim with their Back upright, or at Right Angles to the *Horizon*.

The *oviparous flat Fishes* are either *Quadrati*, or Square, as the *Rhombi* and *Passeres*, or *Longiusculi*, as the *Soleæ*, or *Soles*.

Those that swim with their Backs erect, are either long and smooth, and without Scales, as the *Eel Kind*; or shorter and less smooth, and these have either but one Pair of Fins at their Gills, which are called *Orbs* and *Congeneres*, or else another Pair of Fins also on their Bellies.

There are also *Crustaceous* and *Testaceous Fishes*;

The **CRUSTACEOUS** are those covered with Shells of several Pieces, or Scales, as those of *Crabs*, *Lobsters*, *Craw-Fishes*, *Sbrimps*, &c.

N. B. Dr. *Woodward* observes in his natural History, that of all the Shells and *Nautili* found in Beds of all different Matters, dug out of the Earth, there are scarce any of the *Crustaceous Kind*; the Reason he gives for it is, that these being much lighter than the Rest, must have floated on the Surface at the Time of the Deluge, when all the *Strata* were formed, and there have corrupted and perished.

The **TESTACEOUS** are those covered with a strong, thick Shell, as *Tortoises*, *Oysters*, *Pearl-Fish*, &c.

AMPHIBIOUS (from the Greek, ἀμφί, utrumque, bothways, and βίω, Vita, Life) are a Sort of Animals, which live both on Land and in the Water; i. e. which breathe the Air, but pass Part of their Time in the Water, as affording them their chief Food.—Such are the *Frog*, *Castor*, *Otter*, *Tortoise*, *Sea-Calf*, *Crocodile*, &c.

Most of the *amphibious Kind*, the *Castor* and *Otter* excepted,

excepted, have particular Provisions in their Structure, to fit them for so various a Way of Living, particularly in the Heart, Lungs, *Foramen Ovale*, &c.

N. B. The Term *Amphibious* is sometimes, also, extended to Men who have the Faculty of living a long Time under Water.

We have divers Instances of such amphibious Men; the most remarkable is of a *Sicilian*, named the *Fish Colas*. *Kircher* relates, that from a long Habitude from his Youth, he had so accustomed himself to live in Water, that his Nature seemed to be quite altered, so that he lived rather after the Manner of a Fish, than a Man.

Our Neighbours the *Dutch*, are sometimes called in Irony, *amphibious* Creatures, for they seem to live, rather under, than above Water; their *Digues*, being the sole Obstacle that hinders the Appearance from being changed into a Reality.

VOLATILS are two footed *Animals*, covered with Feathers, and furnished with Wings, whereby they can sustain themselves in the Air, and fly from Place to Place.

They are divided into terrestrial, and aquatick *Volatils*.

Terrestrial Volatils, are subdivided into those which have crooked Beaks, and Talons; and those whose Beaks and Claws are Streighter.

Of those with crooked Beaks and Talons, some are *carnivorous* and *rapacious*, called *Birds of Prey*; others *frugivorous*, called by the general Name of *Parrots*.

Of *Birds of Prey*, some prey in the Day-time, called *Diurnal*; others in the Night, called *Nocturnal Birds*.

Diurnal Birds, are either of a greater, or a lesser Size.—The greater are either of a more bold, and generous Nature, as the *Eagle-kind*; or of a more cowardly and sluggish, as the *Vulture*, and *Cuntor*.

The *EAGLE* is the strongest, largest and swiftest of all the *Volatils* that live by Prey.—It has a long Beak, hooked almost from the Root, yellow scaly Legs, thick, crooked Talons; and a short Tail. Its Plumage is Chestnut coloured, brown, ruddy and white. Its Beak black at the Tip; and in the Middle, blue, though in some Yellow.—The *Eagle* is distinguished from the *Hawk* by its Bigness, and from the *Vulture*, by the Crookedness of its Beak.

Its Aery or Nest is usually on the highest Rocks, sometimes on the Tops of old Trees. It feeds its Young, till such Time as they are able to fly; and then drives them out of the Nest.—Its Food is Birds, Hares, Lambs, Kids, and Fawns; nay, Sir *Robert Sibbald* assures us, Children too, when it can catch them.

Ray mentions an *Eagle's Nest*, found near the River *Derwent* in 1668, which consisted of large strong Sticks, one End whereof was laid on the Crag of a Rock, and the other on two Beech Trees; it was two Yards Square; in it were found one *Eglet*, with the Carcase of one Lamb, one Hare, and three *Grigalli*.

—The *Eagle* frequently watches the Fishing *Hawk*, and as soon as it perceives it to have struck a Fish, takes Wing, pursues the Bird till it lets fall its Prey, and often catches it, before it reaches the Earth or Water.

It lives very long, and as Naturalists assure us, rarely dies but of Hunger, the upper Part of its upper Beak growing long with Age, that it closes up the lower, and so disables it from opening, and taking in Food: But this seems to be a popular Error.

Its Sight is quick, strong, and piercing to a Proverb.—Father *Angelus* the Jesuit, in his *Opticks*, is pleased to assure us, that the Reason why the *Eagle*, whose optick Nerves are not stronger than those of other *Animals*, can face the Sun, in its greatest Glory, is, that it has two Sets of Eye-lids, the one thick and close, and the other thinner and finer, which last it draws over the Eye, when it looks at any luminous Body, and thus breaks the Force of its Rays.

The *Falconers* have trained up *Eagles* to the Game; but they only succeed in mountainous Countries. On Plains they cannot keep any Time on the Wing, and when they stoop or light, are weak, so that the *Saker* beats them.

Aristotle and *Pliny* reckons up six Kinds of *Eagles*, to which they give Names corresponding to the Difference of their Plumage; as the *EAGLE ROYAL*, called by *Aristotle* *γυνομίς* and *ασιπίας* from the ruddy, golden Colour of its Feathers, which are likewise spotted, as it were, with Stars. The *black Eagle*, the smallest and most vigorous of all.—The *white Tail Eagle*.—The *Middle-sized Eagle*, with a large Tail, living in Morasses.—The *Sea-Eagle*, and the *bearded Eagle*, a Kind of *Offisraga*.

The lesser *Diurnal Birds of Prey*, are either of a generous and docible, or cowardly, sluggish, and untractable Nature.

The generous and docible are the *Hawk-kind*, which are wont to be reclaimed, and managed for Fowling.—The *Falconers* distinguish these into *Long-winged*, as the *Falcon*, *Lammer*, *Sacre*, *Gersfalcon*, *Kestrel*, &c. whose Wings reach almost as far as the End of their Train; and *Short-winged*, as the *Gose-hawk* and *Sparhawk*, whose Wings when closed, fall much short of the End of their Train.

The cowardly and sluggish, are neglected by our Falconers, and so live at large.—Of these also there is a greater Sort, as the *Buzzard-kind*, the *Ringtail* and *Kite*; and a lesser, as the *Butcher-kind* or *Sbrike*, about the Bigness of a *Blackbird*.

The nocturnal *Birds of Prey*, with crooked Beaks, and Talons, are the *Owl-kind*, and these are either horned or eared, as the *Eagle-owl*, *Horn-owl*, &c. or without Horns or Ears, as the *brown Owl*, *white Owl*, *grey Owl*, *Howlet*, *Fern-owl* or *Goat-sucker*, &c.

There are three Sizes of the *Land Birds*, or *terrestrial Volatils*, with crooked Beaks and Talons, the greatest of which are called *Maccaws*, and *Cockatoons*; the *Middle sized*, and most common *Parrots* and *Popinjaws*; and the least Sort, *Parakeets*: Those all make Use of their Beak in climbing, and move the upper Jaw.

There are also three Sorts of *Land Birds*, which have their *Bills* and *Claws* more streight; the greatest thereof are such as by Reason of the Bulk of their Bodies, and Smallness of their Wings cannot fly at all, such are the *Ostrich*, the *Cassowary*, and the *Dodo*.

The *Middle-sized* are divided into such as have either large and long, or smaller and shorter Bills.

Of those with large, thick, strong and long Bills, some feed promiscuously on Flesh, Insects and Fruits, as the *Crow-kind*, which are wholly black; and the *Pye-kind*, which are Party-coloured, as the *Magpy*, *Jay*, *Roller*, &c. others feed on Fish only, as the *King's-fisher*; and others on Insects only, as the *Wood-pecker*.

For those which have a smaller and shorter Bill, their Flesh is either white, as the Poultry kind, or blackish, as the *Pigeon*, and *Thrush kind*.

The least Sized-kind of *Land Birds*, with streight Bills, and Claws, are called small Birds.—These are of two Kinds; *Soft-beaked*, which have slender, streight, and pretty longish Bills, most of them, and feed chiefly upon Insects; and *Hard-beaked*, which have thick and hard Bills, and feed mostly on Seed.

Mr. *Willoughby* observes, that among Birds which have streight Beaks and Claws, the *Cassowary* (as well as the *Pelican*) is without a Tongue; swallowing, not only Bits of Iron, as the *Ostriches*, but also red-hot Coals; yet not digesting the Iron, but voiding it whole, as the *Ostrich* also does.

AQUATICK VOLATILS or *Water-Fowls*, are distinguished into such as walk in the Waters, and such as swim in them.

Aquaticks which walk in the Water, are all *Gloven-footed*, and generally have long Legs; and those naked, or bare of Feathers, a good Way above the Knee, that

that they may the more conveniently wade in Waters. Of these they reckon two Kinds; a *greater*, and a *lesser*.—To the greater belong the *Crane*, *Jabiru*, &c.—The lesser are either *Piscivorous*, as the *Heron*, *Spoon-bill*, *Stock*, &c. or *Mudsuckers* and *Insectivorous* or Insect-eaters.

Of *insectivorous* Water-fowl, some have very long Bills, either crooked, as the *Curlew* and *Wimbrel*, or straight, as the *Woodcock* and *Godwith*; others Middle-sized ones, as the *Sea-pye* and *Red-shank*; others short Bills, as the *Lapwing* and *Plover*.

N. B. That those are reckoned short Bills, which exceed not an Inch and Half; Middle-sized Bills to two Inches and an Half; and long Bills, above two Inches and an Half.

Of *Aquatics*, which swim in the Water, some are *Fissipedes*, *Cloven-footed*, as the *Moor-hen* and *Coot*, &c. but most are *Whole-footed* or *Web-footed*. *Palmipedes*.—Of these, some few have very long Legs, as the *Flammant*, the *Avosette* and *Corrira*; but the Generality are short legged.

Of the *short-legged*, *whole-footed Aquatics*, some have but three Toes on each Foot, as the *Penguin*, *Razor-Bill*, &c. but generally they have four Toes on each Foot, and these either all connected together by intervening Membranes, as in the *Pelican*, *Soland Goose*, &c. or more usually with the back Toe loose.

This last Kind are either *narrow-billed* or *broad-billed*; those with narrow Bills, have them either blunt and hooked at the Tip, or sharp-pointed and straighter.

Of the former Sort, some are *ferrate*, as in the *Diver-kind*; and some not toothed, as in the *Puffing*.

Of those with sharp-pointed and straighter Bills, some have long Wings, as the *Gall-kind*, and some shorter, as those *diving Birds*, called *Daukers*.

Those with broad Bills may be divided into the *Goose-kind*, which are larger; and the *Duck-kind*, which are smaller; and these latter into *Sea-Ducks*, or *River* and *Plash-Ducks*.

Most water Fowls have a short Tail; and none of this Kind have their Feet disposed like *Parrots* and *Wood-peckers*, which have two Toes forward, and two backward, whereas none of these have more than one back Toe.

There is also another Kind of *Volatils*, called Birds of *Passage*; such as the *Swallow*, *Quail*, *Stork*, *Crane*, *Fieldfare*, *Woodcock*, *Nightingale*, &c. Those do not appear in our Climates, but at certain Seasons, and then disappear again; but which Way they steer their Course, and whither they go, is what puzzles our *Naturalists*.

Mr. *Willoughby* thinks the *Swallows* fly into *Ægypt* and *Æthiopia*. *Olaus Magnus* says they lurk in Holes, or under Water, which is confirmed by *Etmuller*, who assures us, that he saw a Bushel of them taken out of a frozen Fish-pond, all hanging together Head to Head, Feet to Feet, in one Cluster. *Disp.* 2. c. 10.

Olaus adds, that this is a common Thing in the Northern Countries, and that such Cluster being carried accidentally by some Boys into a Stove, the *Swallows*, after thawing, began to fly about, but weakly, and for a very little Time.

A farther Confirmation of this Account was given by Dr. *Colas*, a Person very curious in such Things, to the *Royal Society*; speaking of the Way of fishing in northern Parts, by breaking Holes, and drawing their Net under the Ice, he related that he saw sixteen *Swallows* so drawn out of the Lake of *Samrat*, and about thirty out of the King's great Pond in *Rosneilen*; and that at *Sblebitten*, near a House of the Earl of *Dobna*, he saw two *Swallows* come out of the Water, that could scarce stand, being very wet and weak, with their Wings hanging on the Ground.—He added, that he had often observed the *Swallows*

to be weak for some Days after their first Appearance.

Mr. *Willoughby's* Opinion is the most improbable of the two, unless he could plainly demonstrate to me, the Way and Manner that long and distant Transmigration, from *England*, for Instance, into *Egypt*, is effected; why at certain Seasons they should prefer *Egypt* to *England*, *France*, *Spain*, *Italy*, &c. and at another, *England*, *France*, *Spain*, *Italy*, &c. to *Egypt*; if for Warmth or Heat, *Egypt* in all Seasons, is preferable to any of those other Climates; if for the Temperature of the Air, why do they visit, at the same Season, the most northern and most southern Countries, under the same Hemisphere? Or why don't they keep always in *Italy* or *Spain*, where at all Times and in all Seasons, they could enjoy a more serene Sky, and a greater and more equal Temperature of Air, than in *Egypt* or *Æthiopia*. But perhaps they are natural Inhabitants of those Countries, or born Subjects of *Prester John*, or of the *Turk*, and only take a Trip every Year here amongst us, to see how far we improve in our Customs and Manners, which considering the small Distance of Places, is a pretty Pastime enough; only I would be glad to know their Way of travelling, if by *Sea* or *Land*? Though *Lud de Beaufort*, is pleased to tell us, that they fly in Troops, and steer their Course through huge unknown Regions, without the Compass, which they can easily do, being accommodated by the Structure of their Back for long Flights; but he should also add, for our greater Satisfaction, that he has seen them upon their Journey, or received that curious Information from some of their fellow Travellers, else some Body would be apt to question the Truth of his Account.

Olaus's Sentiment, that those Birds lurk in Holes, is more agreeable to Reason, and a *Phænomenon* very easily to be accounted for; since it is likely enough that those, like the *Swallows*, which seek after warm Climates, should retire in the Winter's Season under Ground, or into Holes, where at that Time the Air being more condensed, is more temperate; we know likewise by Experience, that the *Woodcocks* and other Sort of Winter Birds, can be sheltered in the same Holes, against the scorching Heat of the Summer Season.—But those Circumstances added by *Etmuller* and Dr. *Colas*, that the *Swallows* in particular, wrap themselves in Ice, against the Rigour of the Winter, is, in my Opinion, as good an Expedient, as to throw one-self into Water to avoid being wet by the Rain; unless they would give for Reason, that by the Ice seizing all the Pores of the Body, their native Warmth is concentrated within, which keeps them alive till the Return of a warmer Season.

Mr. *Duerham* observes two Things remarkable in the *Migration of Birds*; the first, that those untaught, unthinking Creatures, should know the proper Times for their Passage, when to come and when to go; and also that some should come when others go.—He supposes that the Temperature of the Air, as to Heat and Cold; and their natural Propensity to breed their Young, are the great Incentives to those Creatures to shift their Habitation; but why should they at all shift their Habitation, and why is not some certain Place to be found in all the terraqueous Globe, affording them convenient Food, and Habitation all the Year round?

The second, that they should know what Way to steer their Course, and whither to go.—What Instinct is it that moves a poor foolish Bird, to venture over vast Tracts of Land and Sea? If it be said that by their high Ascents up into the Air, they can see cross the Seas; yet what should teach or persuade them that that Land is more proper for the Purpose than this? that *Britain*, for Instance, should afford them better Accommodation, than *Egypt*? than the *Canaries*? than *Spain*? or any other the intermediate Countries? *Physico Theol.* p. 349.

These are Mr. *Duerham's* *Queries*, upon the Passage of those Birds into *Egypt*, for he is also one of those who

who would have *Egypt* to be their Place of Refuge; which Doubts he could himself easily resolve, if he would consider, that there is nothing more extraordinary in those Birds disappearing and vanishing from our Sight at certain Times of the Year, than there is in some of our Insects following the same Instinct, though not so much taken Notice of by us. That those Animals being created like the rest, and the just Symmetry of their Organs calculated for their Preservation (no other Object being offered to them but that Preservation for which alone they exist, and live) they in Consequence are directed to all the Means which can contribute towards obtaining that End; which Means are the Air they breathe, their Food, and their Security against the Injuries, and the Inclemency of the Climates they are hatch'd in. That being deny'd the same Art we have of temperating the Extremes of Heat, or Cold, Nature makes them acquainted with all the Places of their native Soil (unknown to us) which can supply that Want, where they retire at the Time appointed by her, and where she provides them with Food necessary for their Subsistence, till invited by the Return of a Season more favourable to them, they appear again in their native Element the Air. This my Opinion is a great deal easier to be accounted for, than their long and tedious Flight into *Egypt*, or *Æthiopia*, or even the Moon, which some of our late overwise Naturalists have also appointed for a Place of Refuge, to these Animals improperly called *Birds of Passage*.

INSECTS, are also a *Species* of terrestrial Animals, but smaller than those heret fore mentioned, commonly supposed to be exsanguinous, and distinguished by certain Incisures, Cuttings, or Indentings in their Bodies.

They are divided by Mr. Ray into those that change their Form, and those that do not change their Form.

Insects which do not change their Form, are either with Feet, or without Feet, and of these some cast their Skin, and others do not.

Those without Feet are either Land *Insects*, or *Aquatic-Land-Insects*, are either produced on the Land, or in the Bowels of Animals.—Those produced on the Land, are either of the larger Size, as the *Dew-worms*, or of a smaller Sort, of which some are green, and others red with yellow Tails, called *Guilt-tails*.

Those found in the Bowels of Animals, particularly in the Intestines of Men, are the *Lumbrici Teretes*; *Lumbrici Latii*, also called *Taniæ*; *Culurbitini*, which some believe to be only the Fragments of *Taniæ*; and *Ascarides*, chiefly found in the *Rectum*.

The *Vermiculi Setiformes*, of the Thickness of a Horse-hair, and the *Breves*, and *Craffiiores* or *Botts*, are the two Sorts found in the Intestines of Beasts, the latter being oftner discovered in Horses than in any of the others.

Aquatic Insects, without Feet, not changing their Form, are either of the greater, or of the lesser Sort.—Of those of the greatest Sort, some are *Tiretes*, round and smooth, of which there are three Sorts, the medicinal *Hirundines*, or *Leaches*, the common black Horse-Leaches, and the ash-colour'd Sea-Leaches: Another Sort of the same Kind, only smaller and flatter, is found sticking to Stones, in the Bottom of little Brooks: All these move by first fixing their Head to the Ground, and then drawing up their Tail towards it, &c.

Those of the lesser Sort, are also either round, or flat: Of the round Sort, one is black with two small Horns on its Head, found sticking to wet Stones in the watry Tops of Hills; and another red, about a Finger's length, with a *Forceps* at the Tail, found at the Bottom of Fish-ponds, and stagnant Waters.—The flat Sort, called *Flukes*, are very small and thin, and found sometimes in Water, and sometimes in the Branches of the *Porus Bilaris* in Sheep.—These have a different Way of moving or *crawling*, from the greater Sort.

Insects which do not change Form, and have Feet, are either with six, eight, fourteen, or many Feet.

Those with but six Feet, are either *Terrestrial* or *Aquatic*.—Of the *Terrestrial* there are two Sorts, a larger, and a smaller Sort.—Of the larger Sort are, the yellowish *Insect*, found in rotten decaying Oaks; the black one, on the Ground, called by *Mouffet* *Vermivorus*, *Worms-Devourer*; the black one living under Ground with a *Forceps* at the Tail; a white Sort, with square black Spots on its Back; the *Farinarium*, bred in Meal, of a whitish Colour.

Of the smaller Sort, some are found about the Bodies of Animals, as the *Cymex*, *Bug*, or *Wall Louse*, of a stinking Smell; *Ricinus*, the *Tick*; *Pediculus*, the common *Louse*; *Pulex*, the *Flea*; *Pediculus ferus*, seu *inguinalis*, the *Crab-Louse*; and others are not found on the Bodies of Animals; as one found in Books, and rotten Wood, which resembles a *Louse*, both in Figure and Bigness, though a great deal nimbler and swifter; another with a longer Body and a forcipal Tail; the *Black Insect*, found often in the Flowers of *Chelidonium*; a subterraneous Sort, a little whitish; and one that skips like a *Grashopper*, but is much less.

The *Aquatic* are the *Pediculus marinus grandis*, which adheres to Fishes; and the *Squilla fluviatilis*, with a pyramidal Tail, and two Hairs or Bristles at the End.

Insects not changing Form, and with eight Feet, are either with a Tail, as the *Scorpion*, or without; as first, the *Spider*; of which some spin no Web, have but two Eyes, and very long Legs, as the *Opilio* or *Shepherd*: Others spin a Web, and of these they count three Sorts. 1. the *Aranea Colustrensis abdomine timido subrotundo*, &c. *Elato*. 2. the *Spider* with the *Thorax*, or middle Part of its Body, as big as the *Abdomen*. 3. The *Spider* with the long *Abdomen*, found among Reeds, Rushes, Grass, &c. Secondly, the *Riciniæto pedes*, which are some more flat and compressed; as the *Rambling Ticks*, that run over the Bodies of Animals, but do not fasten; and some more round and thick, which do adhere to the Skin. Thirdly, the *Syrones*, or *Mites*.

There are three Sorts of *Asilli*, or of *Insects*, not changing Form, and with fourteen Feet; as the *Sea-Asellus*, living among the Rocks, which is the longest and largest Sort; the *Asellus Lividus*, which rolls itself up into a Ball, the common *Wood-lice*, *Sows*, or *Chest-Bugs*; and the *Asellus Aspinus*, with a forked Tail, not rolling itself up.—To which may be added the *Asellus Marinus*, rolling itself up; the *Asellus Aquarum dulcium*, with long Legs, and two Bristles on its Tail; *Pulex Aquaticus*, both in fresh and salt Water; and the *Pediculus Aquaticus*, which fastens upon Fish.

The Naturalists have observed two Kinds of *Insects*, not changing Form with four and twenty Feet, the eight fore-Feet lesser, and the sixteen hinder ones larger, and both with long Bodies; the larger Sort is of an obscure Colour, which live among the Rocks by the Sea-side; and the lesser of a Silver Colour found in Houses.

There is also a Kind with thirty Feet, of an oblong Shape, Chestnut Colour, and full flattish Body, usually lying under Logs and Trunks of Trees; it is very agile and swift.

Insects, not changing Form with many Feet, called *πολυποδα*, are some on Land, and either roundish in Body, with all their Legs rising out of the Middle of their Belly, as the *Julus*; or more flat and compressed, with their Legs not rising as before, from a Point in the Middle of their Body, but growing along on the Side, as the *Scolopandra*.

Swammerdam shews there is no real Transformation in *Insects*, supposed to undergo a Change in their Form, but only an Explication of the Parts of the *Animal*, latent before in Miniature, like the Plant in the Seed, and an Increase of the Parts by proper Degrees.

The first *Species* of Transmutation, or Change, is instantaneous.

instantaneous, *i. e.* there is no sensible Rest or Stop, between the old and the new Form.—The *Insects* of this Order do not lose their Motion at the Time they shift the *Pellicula*, at least not to Appearance.—This is when the *Vermiculus*, leaving the former Shape of the *Nympha*, with which it appeared in the Egg, and subsisted without Food, now begins to feed, has its Members or Parts visibly increased, or stretched out, and takes the Form of a new *Nympha*, which is not without Motion; and from thence becomes a flying Insect.

There are twelve Sorts of these *Insects*. 1. The *Libella*, or *Portia*, produced from an Insect of six Feet, which *Musset* takes for the *Pulex Marinus*, through whose cruttaceous Skin the *Libella* breaks by a Fissure, which begins between the Eyes, and is continued to the Roots of the Wings, and is there joined to the lateral Fissures. 2. The *Cimices Sylvestres*, whose Characteristick Marks (according to *Willoughby*) are, *first*, a long *Proboscis*, not spiral, but strait; *secondly*, their upper Wings to the Middle are thick and like Leather; thence to the End thin, and Membranous; *thirdly*, there is the Figure of St. Andrew's Cross on their Back. 3. The *Locusta*. 4. The *Gryllii Campestris*. 5. The *Gryllii Domestici*, or *Crickets*. 6. The *Mole-Cricket*. 7. The *Grasshopper*. 8. The *Blatta*. 9. The *Tipula Aquatica*, which run very swiftly on the Surface of the Water, and have a Sting in their Mouth like the *Cimices* or *Ticks*. 10. The *Scorpius Aquaticus*, with a Sting also in its Mouth. 11. The *Musca Aquatica*, called by *Aldovrandus*, *Apes Amphibia*. 12. The *Emerobius*, or *Ephemera*, or *Diaria* of *Swammerdam*, the *Forficula*, or *Auricularia*.

The second Species of Transmutation includes such *Insects* as undergo a double *Metamorphosis*, or Change of Shape. 1. Into a *Chrysalis*, or something analogous to it. 2. Into a flying Insect. These Kinds of *Insects* a-while before they change, lie quite still, without Feeding or changing Place; and in Respect of their Wings are, *first*, *Vaginipennia*, as *Scarabæi*, Beetles. *Secondly*, *Anisoptera*, whose Wings are open, and expanded; and the Wings of these are either farinaceous, as the *Papiliones*, &c. or Membranous, as the *Apes*, *Musca*, &c. and these are either with two, or with four Wings.

The *Scarabæi* may be divided; 1. With Respect to their Horns into the *Nasicornis*, *Bucerota*, and *Cervus Volans*, or *Taurus*. 2. In Respect of their *Antennæ*, which are of many Kinds; whereof the most eminent are those called *Capricorni*. 3. With Regard to their Motion, as the *Saltatrices* Dancers. 4. With Regard to their Colour, as the *Cantbarides*, *Spanish Flies*.

To the *Beetle*-Kind may also be referred the *Cicindela*, or *Glow worm*, the *Staphylinus*, the *Proscarabæus*, or *Oil Beetle*, so called, from its emitting from its Joints a Kind of Oil, on its being pressed or squeezed. The *Anelytra*, with farinaceous, or mealy Wings, are called *Papiliones*, *Butterflies*; and these are either diurnal or nocturnal.

The Specific Distinction of the diurnal *Butterflies*, or *Papiliones* is, that they always settle with their Wings erect, are produced from an *Angulous Aurelia*, and have their *Antennæ* studded; of these there are above fifty Sorts observed in *England*.

The *Nocturnal Butterflies*, though very numerous, may nevertheless be divided into,

1. The *Geometrigena*, (thus called, from the Manner of its walking with its Back curled up like the Handle of a Cup) which come from an *Erucæ*, and has eight or ten Feet. 2. Such as come from *Erucæ* with fourteen Feet; of this Kind which is very numerous, there has been distinguished the *Phalena Fasciata*, whose Wings are in Patches, or *Area's* of different Colours; *Phalena Lineata*, whose Wings are marked with one or more Points; and these, except all the others, are distinguished into greater, lesser, and of a middle Size between both.—One of the larger Kind may be distinguished also, by their inner Wings; and a third by their long Tails, and narrow

sharp Wings; which by some are called *Phalena Prædatrices*.

The *Anelytra* with membranous Wings are *Bees*, *Flies*, *Wasps*, *Bombylii*, *Crabrones*, &c. and to this Kind the *Culex Vulgaris*, or *Gnat*, according to *Swammerdam*, is referred, as also the *Formica*, or *Ant*.

Willoughby refers also to this Kind, such Water *Insects* as are covered with a *Theca*. These are either, *first*, an immoveable *Theca*, or Case, which is fixed to the Stones; and this Case is either of a round Figure, or one more compressed and flat. *Secondly*, A moveable portable *Theca*, and these are commonly called *Phryganæa*; and their *Theca* is either, 1. Strait, and that either composed of Straws, and little *Festucæ*, lying parallel one to another; of which there are two Kinds; a greater where the *Festucæ* are two Inches long; and a lesser, which are very common, and are called *Straw-Worms*; or else the *Festucæ* lie transversely, and are shorter, having sometimes Pieces of Shells, or Stones, intermixed with them; others whose Cases are strait also have no *Festucæ*, but always either Sand, or Gravel; of these some have the *Theca* round, and are called *Cod-Baits*; others are flat, and compressed. 2. Crooked, or horned, which run tapering; of these Mr. Ray reckons four Kinds; a greater and less black Sort, and a greater and less ash-coloured one. These all produce Flies with large Wings like *Butterflies*.

The third Species of Transmutation, is a simple Change from a *Vermiculus* to a flying Insect; but with a sensible Rest or Stop between one Form and the other. This Exchange is described by *Swammerdam* in the following Manner.

‘The Vermicle excluded from the Egg (says he) gets Nourishment by little and little from without, and under that first Skin or Covering, has its Members increased by Degrees; not stripping it or putting it off, as other *Vermiculi* do, when they change into *Nympha*, but assuming the Figure of a *Nympha* in it. For a Time it is quite motionless, till the superfluous Moisture is evaporated, and then, in a few Days recovers its Motion again, and casting off this Skin, which is, as it were, double, it becomes a Fly.’—Of this Kind are our *Flesh-Flies*, and all the *Nympha Vermiformes*, the *Vespa Ichneumones*, &c.

The modern Naturalists agree with the modern Anatomists, that *omnia ex Ovo*, or every Thing comes from its Egg, and that *Insects* are propagated that Way as well as all the other *Animals*, contrary to the Opinion of the ancient *Naturalists*, who thought them bred of Corruption.

The Doctrine of equivocal Generation, as well as the Chimerical Transformation of *Caterpillars* into the *Butterfly*, and other the like *Metamorphoses* are sufficiently refuted by *Malpighi*, *Swammerdam* and *Redy*; who have shewn that all the Members of the *Butterfly* were enclosed under the Skin or *Nympha* of the *Caterpillar*, as the Parts of a Plant are in the Seed.

Insects, take particular Care to deposite their Eggs or Seed, in such Places where they may have a sufficient Incubation, and where the Young when hatched, may have the Benefit of proper Food, till they become able to shift for themselves.—Those whose Food is in the Water, lay their Eggs in the Water; those to whom Flesh is a proper Food, in the Flesh; and those to whom the Fruits or Leaves of Vegetables are Food, are accordingly deposited, some in this Fruit, some in that Tree, and some in that Plant, and some in another, but constantly the same Kind in the same Tree, &c.—As for others that require a more constant and greater Degree of Warmth, they are provided by the Parent Animal, with some Place in or about the Body of other Animals; some in the Feathers of Birds, some in the Hair of Beasts, some in the Scales of Fishes, some in the Nose, some in the Flesh, nay some in the Bowels, and in most Recesses of Men and other Creatures.—And as for others, to whom none of those Methods are proper, they make them Nests by Perforation in the Earth, in Wood,

Wood, in Combs, and the like; carrying in and sealing up Provisions that serve both for the Production of their Young, and for their Food when produced, as the *Formica* or *Ant*.

This *Insect*, by its constant Care and assiduous Labour, to provide for its Preservation, and that of its Progeny, is, in my Opinion, more than sufficient to convince the *Cartesians* of the Extravagancy of the System they have formed on the *Animal's* Motions; for what artificial Mechanism, let the Symetry of its Parts be ever so regular, could be directed by the Justness and Regularity of the Motions of its *Springs*, to distinguish the Seasons of the Year, and to follow in that single Circumstance, all the Steps of the most careful and greatest *Œconomists*, of the rational Kind, to erect Buildings in the most proper Situation, with different Apartments, some for the Winter, and some for the Summer Seasons, with Granaries and Store-places for Provisions of all Kinds? What could, but something above the Apprehension of the most expert *Mechanick*, inform the *Ant*, of the proper Seasons to fill up those Granaries; and of the most fertile Fields where to go a maroding for that Purpose? What Piece of Mechanism could teach them when to fall out, and when to keep within their Retrenchments? how to foresee a Storm, or a Shower of Rain, and to avoid it, as threatening their Life and entire Destruction? Could a *Cartesian* attempt to convince me, at least with some Appearance of Reason, that any Thing else, but a *sensible Soul*, susceptible of Hunger, Cold, Fatigues and Pain, could direct the *Ant* in all those Motions? could assign to every one of them its particular Employment? could send some to fetch Water, others Pebbles, Gravel, Sand or Earth, for building their Habitation, and others to provide Food for the whole Common-wealth; those to lend a helping Hand to some of them who are overburthened; and these, as *Conservators of Health*, to carry out of the common Mansion, all the politick Members rendered useless by Death, or some other Accident? What *Master-spring* in their whole *Mechanism*, could direct them (when, by some unexpected Misfortune, their Edifices are demolished, all their Stores scattered, and the whole Society dispersed, or put to Flight) how to make a Difference between their Eggs, and their other Goods, and provide for the Security of them first? Are we ourselves more regular, in our sensitive Faculties, and more intent on our Preservation, and on that of our Species? Not that I would insinuate by this, that those *little Insects*, have something supernatural within them, which directs them in all these Motions; but I really believe that they have a sensitive Faculty, which in us is always in Action and Watch on our Preservation, even while our Rationality sleeps.

It is observed, that there is a Kind of Gluten in *Flies*, *Butter-flies*, &c. by which the Female fastens her Eggs to the bearing Buds of Trees, &c. so that the Rain cannot wash them off.—These Eggs will not be hurt by the greatest Frost.

Audrey de le generation des vers dans le Corps de l'homme, takes Notice that the *Antients* were mistaken in denying that *Insects* did breathe, because of their wanting Lungs; since modern Observations convince us, that *Insects* have a greater Number of Lungs than other *Animals*.

The *Antients* thought, also, that *Insects* had no Blood, because many of them had no red Liquor like our Blood; but it is not the Colour but the Use of the Liquor that is to be regarded.

They believed also, that *Insects* had no Hearts; whereas our Microscopes do now discover, that when *Insects* have several Lungs, they have also several Hearts; and in particular it is found that *Silk-worms* have a continued Chain of Hearts, from the *Thorax* almost to the very Extremitie of the Tail.

The *SILK-WORM* is an *Insect*, not more remarkable for the precious Matter it furnishes for divers Stuffs, than for the many Forms it assumes, before, and after its being invellaped in the rich Cod,

or Ball it weaves itself. From a small Egg, about the Size of a Pin's Head, which is its first State, it becomes a pretty big Worm or Maggot, of a whitish Colour, inclining to yellow.—In this State it feeds on Mulberry-leaves, till being come to Maturity, it winds itself up into a filken Bag or Case, about the Size and Shape of a Pigeon's Egg; and becomes metamorphosed into an *Aurelia*: In this State it remains without any Sign of Life or Motion; though it casts a Life, by which it prepares itself for a new Life, and then dies, which Egg wants no other Incubation, than the Warmth of the Summer-weather, or of some other gradual Heat.

As soon as the *Silk-worm* is arrived at the Size and Strength, necessary for beginning its Cod, he makes his Web; for thus they call that slight Tissue, which is the Beginning and Ground of that admirable Work.—This is his first Day's Employment. On the second, he forms his *Folliculus* or Ball, and covers himself almost over with Silk. The third Day he is quite hid; and the following Days employs himself in thickening and strengthening his Ball, always working from one single End, which he never breaks by his own Fault, and which is so fine and so long, that those who have examined it attentively, think they speak within Compass, when they affirm that each Ball contains Silk enough to reach the Length of six *English* Miles.

In ten Days Time the Ball is in its Perfection; and is now to be taken down from the Branches of the Mulberry-tree, where the Worms have hung it.—But this Point requires a deal of Attention; for there are some Worms more lazy than others; and it is very dangerous waiting till they make themselves a Passage, which usually happens about the fifteenth Day of the Month.

In 1710, Mr. *Bon*, a *Frenchman*, published a Dissertation on a Secret, found in *France*, of procuring and preparing Silk of the Webs of *Spiders*.

Mr. *Bon* reduces the *Silk-spiders* to two Kinds, those with long Legs, and those with short, which last are those which furnish the raw Silk.

The Author pretends that the *Silk-spider* makes a Silk every whit as beautiful, glossy, and strong as the *Silk-worm*, that it spins it out of the *Anus*, around which are five *Papillæ*, or small Nipples, and behind these two others; all muscous, and furnished with Sphincters.—These Nipples serve as so many Wire-drawing Irons, to form and mould a viscous Liquor, which when dried in the Air, after being drawn through them, makes the Silk.

Mr. *Reaumur* observes, that each of these Nipples consist of a Number of lesser, and insensible ones; which one may be convinced of, by pressing a Spider's Belly between the Fingers, to oblige the Liquor to flow into the Nipples; for by this Means, applying the Finger against the *Anus*, several distinct Threads will be drawn out through the several Perforations of the Nipples.—The Threads are too fine to be told with any Certainty; but Mr. *Reaumur* reckons each larger Nipple may send forth six or seven.

Hence we see how the *Spiders* make their Threads bigger or smaller: For as before they begin to spin they always apply more or fewer of these six Nipples, against the Body whence the Web is began; or as they apply each more or less strongly, so as more or fewer of the minuter Nipples come to take; the Thread thus spun, will be a Compound of more, or fewer of the single Threads.—Indeed as the Threads come from the *Anus*, all joined together, they appear to be single; but Mr. *Bon* has distinguished one of the single ones to consist of fifteen or twenty distinct Threads.

The Threads are of two Kinds; the first is weak, and only serves for that Kind of Web wherewith they catch *Flies*.—The second is much stronger, and serves to wrap up their Eggs in; which by this Means are sheltered from the Cold, as well as from *Insects*, which might otherwise gnaw and spoil them.

—These Threads they wind very loofely round the Eggs, resembling the Balls, or Bags of *Silk-worms*, that have been prepared and loofened for the Distaff.

The Spider-bags are of a grey Colour when new; but turn blackish when long exposed to the Air: Indeed one might find other Spider bags of other Colours, and which afford a better Silk, but their Scarcity would render the Experiment difficult; for which Reason we confine ourselves (says M. Bon) to the Bags of the most common *Spiders*, which are the short-legged Kind.—These always find out some Place secure from the Wind and Rain, to make their Bags; as hollow Trees, the Corner of Windows, or Vaults, or under the Eaves of Houses.

By collecting a Quantity of these Bags, a new Silk is made, not inferior to the common Silk. It takes all Kinds of Dyes, and may be made into all Kinds of Stuffs.—Mr. Bon had Stockings and Gloves made of it, which he presented to the *Academy*; and others to the *Royal Society*.

For the Manner of preparing the Bags to get the Silk, it is thus: After having gathered twelve or thirteen Ounces of these Bags, Mr. Bon had them all beaten for some Time, with the Hand and a Stick, to get out all the Dust; he then washed them in luke-warm Water, till they left the Water very clean; after this he laid them to steep in a large Vessel, with Soap, and Saltpetre, and Gum-arabick.—The whole was left to boil over a gentle Fire for three Hours; the Bags were next washed in warm Water, to get out the Soap; and after all, laid to dry some Days to fit them for carding; which was performed by the common *Silk-Carders*, but with *Cards* much finer than ordinary.—By this Means he had a Silk of a very particular Ash-colour, which was easily Spun; and the Thread spun from it, both stronger and finer than that of common Silk; which shews that all Sorts of Works may be made of it: Nor is there any Reason to fear, but it will stand any Trial of the Loom, after having passed that of the Stocking-weavers.

The only Difficulty now is in procuring a sufficient Quantity of *Spider-bags* to make any considerable Work of it; which Mr. Bon observes would be no Difficulty at all, had we but the Art of breeding them, as they do *Silk-worms*. For they multiply much more; every *Spider* laying 6 or 700 Eggs, whereas *Silk-worms* do not lay above 100; yet are these last so tender, &c. that one Half dye without making any Bags, or are hindered by some little Accident, from making their Bags; whereas the *Spiders* hatch of themselves, without any Care, in the Months of *August* and *September*, in fifteen or sixteen Days after they are laid; the old *Spiders* that lay them, dying soon after. The young ones thus bred, live ten or twelve Months without eating, and continue in their Bags without growing, till the hot Weather putting their viscid Juices in Motion, forces them to come forth, spin, and run about to seek Food.—Were therefore a Way found of breeding young *Spiders* in Rooms, they would, doubtless, furnish a much greater Quantity of Bags than *Silk-worms* do; for of 7 or 800 young *Spiders*, which Mr. Bon kept, scarce one died in a Year; whereas of 100 *Silk-worms*, not forty lived to make their Bags.

Mr. Bon having ordered all the short-legged *Spiders* that could be found in the Months of *August* and *September*, to be brought to him, shut them up in Paper Coffins and Pots; covering the Pots with Paper, which he prick'd full of Pin-holes, as well as the Coffins, to give them Air.—He fed them with Flies, and found some Time afterward, the greatest Part of them had made their Bags.—The same excellent Person found that *Spiders* Bags, with Regard to their Weight, afford much more Silk, than those of the *Silk-worms*; as a Proof hereof, he observes that thirteen Ounces, yield near four Ounces of clear Silk, two Ounces whereof will make a Pair of Stock-

ings; whereas Stockings of common Silk weigh seven or eight Ounces.

Nor is there any Venom in the *Silk*, or even in the *Spiders*, as many have imagined. Mr. Bon has been bit by them several Times, without any Manner of Harm; and as for the Silk, it is used with very good Success, to stop bleeding and cure Wounds; the natural Gluten thereof acting as a Kind of Balsam.—It likewise yields by Distillation, several specifick Medicines, particularly a great Quantity of Spirit, and volatile Salt, which being prepared after the same Manner, as that drawn from the Bags of *Silk-worms*, in making the *Guttæ Anglicanæ*, or *English Drops*, so famous over all *Europe*; may serve to make Drops of greater Efficacy, which Mr. Bon calls *Drops of Montpellier*, to be used in *Lethargick Affections*.

Mr. *Reaumur* being appointed by the *Royal Academy*, to make a further Enquiry into this new *Silk-Worm*, has raised several Objections and Difficulties against it; which are found in the Memoirs of the Academy, for the Year 1710. The Sum of what he has urged, amounts to this.—The natural Fierceness of the *Spider*, renders them unfit to be bred, and kept together; 4 or 5000 of them being distributed into Cells, 50 in some, 100 or 200 in others; the big ones kill and eat the less, so that in a short Time, there were scarce left one or two in each Cell: And to this Inclination of mutually eating one another, Mr. *Reaumur* ascribes the Scarcity of *Spiders*, considering the vast Number of Eggs they lay.

But this is not all; he even affirms that the *Spider's* Bag is inferior to that of the *Silk-worm*, both in Lustre and Strength; and that it produces less Matter to be manufactured. The Thread of the *Spider-web*, only bears a Weight of two Grains, without breaking; that of the Bag bears thirty-six; the latter therefore, in all Probability, is eighteen Times thicker than the former; yet it is weaker than that of the *Silk-worm*, which bears a Weight of two Drams and a Half. So that five Threads of the *Spider's* Bag, must be put together, to equal one Thread of the *Silk-worm's* Bag.

Now it is impossible these should be so justly applied over one another, as not to leave little vacant Places between them, whence the Light will not be reflected; and of Consequence, a Thread thus compounded, must fall short of the Lustre of a solid Thread. Add to this, that the *Spider's* Thread cannot be wound off, as that of the *Silk-worm* may, but must of Necessity be carded; by which Means being torn in Pieces, its Evenness, which contributes much to its Lustre, is destroyed.—In Effect, this Want of Lustre was taken Notice of by Mr. *De la Hire*, when the Stockings were presented to the *Academy*.

Again; *Spiders* furnish much less Silk than the *Worms*: The largest Bags of these latter weigh four Grains; the smaller, three Grains; so that 2304 *Worms* produce a Pound of Silk. The *Spider's* Bags do not weigh above one Grain; yet when cleared of their Dust and Filth, lose two Thirds of their Weight; the Work of twelve *Spiders*, therefore, only equal that of one *Silk-worm*; and a Pound of Silk will require, at least 27648 *Spiders*. But as the Bags are wholly the Work of the Females, who spin them to deposit their Eggs in, there must be kept 55296 *Spiders* to yield a Pound of Silk. Yet this will only hold of the best *Spiders*; those large ones ordinarily seen in Gardens, &c. scarce yielding a twelfth Part of the Silk of the others. 280 of these, he shews, would not do more than one *Silk-worm*; and 663552 of them would scarce yield a Pound.

Spiders, are so useful to the civil Society, that they not only procure Matters for our Raiment, but also contribute towards our Pleasure and Diversion; those found in some Parts of *Italy*, and by the *Naturalists*, called *Tarantula's*, from the City of *Tarentum*, in *Apulia*, where they are chiefly found; being better Dancing-Masters, than ever *France* itself has produced.

The *TARANTULA* is about the Size of an Acorn, and

and has eight Feet, and as many Eyes; its Colour various, but it is still hairy: From its Mouth arises two Horns, or Trunks, made a little crooked, with Tips exceedingly sharp, through which it conveys its Poison.—M. *Geoffroy* observes, that these Horns are in continual Motion, especially when the *Animal* is seeking for Food; whence he conjectures they may be a Kind of moveable Nostrils.

The *Tarantula* is found in several other Places of *Italy*, and even in the Isle of *Corfica*; but those of *Apulia* alone are dangerous; even these when removed thence, are said to become Harmless; even in *Apulia*, none but those found on the Plains are much to be feared; the Air being hotter there than in the Mountains.—M. *Geoffroy* adds it as an Opinion of some, that the *Tarantula* is never venomous but in the coupling Season; and *Baglivi*, that it is never so but in the Heat of Summer, particularly in the Dog-Days, when becoming enraged it flies on all that pass by.

The Bite occasions a Pain, which at first appears much like that felt on the Stinging of a *Bee*, or an *Ant*: In a few Hours the Patient feels a Numbness, and the Part affected becomes marked with a little livid Circle, which soon after rises into a very painful Tumor; a little longer, and he falls into a profound Sadness, breathes with much Difficulty, his Pulse grows feeble, his Sense fails, at length he loses all Sense and Motion, and dies unless relieved.—But these Symptoms come somewhat differently, according to the Nature of the *Tarantula*, and the Disposition of the Patient. An Aversion for black and blue; and on the contrary, an Affection for white, red, and green, are other unaccountable Symptoms of this Disease.

All the Assistance Medicine has been able to discover by Reasoning, consists in some chyrurgical Applications on the Wound, in Cordials and Sudorificks; but these are of little Efficacy: A Thing that avails infinitely more, is what Reason could never have thought of, *Musick*.—As soon as the Patient has lost his Sense and Motion, a Musician tries several Tunes, on an Instrument; which, considering 'tis in *Italy*, the Physician's Fees, nor the Apothecary's Bill, cannot be very exorbitant, and when he has hit on that, the Tune and Modulation whereof agree to the Patient, he is immediately seen to make a feint Motion: His Fingers first begin to move in Cadence, then his Arms, then his Legs, by degrees his whole Body; at length he rises on his Feet, and begins to dance; his Strength and Activity still increasing.—Some will continue to dance for six Hours without Intermision.

After this the Patient is put to Bed; and when he is judged sufficiently recruited from his first Dance, he is called to a second Tune of the same.—For my Part I am apt to believe, that our crafty Ladies of Pleasure, who would pretend to hide their Debauchery, under a frivolous Pretext of an extream Passion for that polite and gentle Exercise the Dance; and on that Account are seen at all the publick Feasts, and Balls in the City, and afterwards go to recruit themselves from their Fatigues, in the Arms of a young Spark, have been bit by the *Tarantula*, or something else as venomous.

But we must not leave our Patient, who having continued this Exercise for several Days, six or seven at most; finds himself exceedingly fatigued, and unable to dance any longer (contrary to our Dancing Ladies, who the more they dance, the more they desire to dance) which is the Sign of his being cured; for as long as the Poison acts on him, he would dance, if one pleased, without any Discontinuation, till he dies of the mere Loss of Strength.—Perceiving himself weary, he begins to come to himself; and awakes as out of a profound Sleep, without any Remembrance of what has passed in his Paroxysm, not even of his Dance.—Sometimes thus recovering from his first Access, he is quite cured; if he be not, he finds a melancholy Gloom hanging on him; he shuns the Sight of Men, and seeks Water; and if he be

not carefully look'd to, throws himself into some River.—If he do not die, the Fit returns at that Time twelvemonth, and he is driven to Dancing again.—Some have had these Returns regularly for twenty or thirty Years.—Every *Tarantatus*, or Person bit by the *Tarantula*, has his particular and specifick Tune, but in general, they are all very brisk, sprightly Tunes, that work the Cure.

We are indebted for this Account of the *Tarantula* to M. *Geoffroy*, who, at his Return from *Italy* in 1702, gave it to the Royal Academy of Sciences at *Paris*; and was pleased, likewise, to give us along with it a Theory of the Effects of the *Tarantula's Bite*, whose poisonous Juice, M. *Geoffroy* conceives, may give the Nerves a Degree of Tension, greater than is natural to them, or than is proportionable to their Functions: And hence arises a Privation of Knowledge and Motion.—But at the same Time this Tension, equal to that of some Strings of an Instrument, puts the Nerves in *unison* to certain Tones, and obliges them to shake, after being agitated by the Undulations and Vibrations of the Air proper to those Tones.—And hence this wonderful Cure by Musick: The Nerves thus restored to their Motion, call back the Spirits thither, which before had abandoned them.—It may be added with some Probability, and on the same Principles, that the Patient's Aversion for some Colours arises hence, that the Tension of his Nerves, even out of the Paroxysm, being still different from what it is in the natural State, the Vibrations those Colours occasion in the Fibres of the Brain, are contrary to their Disposition, and occasion a kind of Dissonance, which is Pain.

Dr. *Mead* is of Opinion, that the Malignity of the Poison of the *Tarantula* seems to consist in its great Force and Energy, whereby it immediately raises an extraordinary Fermentation in the whole arterial Fluid; by which its Texture and Crasis is considerably altered: The Consequence of which Alteration, when the Ebullition is over, must necessarily be a Change in the Cohesion of its Parts, by which the Globules, which did before with equal Force press each other, have now a very different and irregular *Nisus*, or Action; so that some of them do so firmly cohere together, as to compose *Molecule*, or small Clusters.—Upon this Account, as there is now a greater Number of Globules, contained in the same Space, than before; and the Impulse of many of these, when united together, differing according to the Conditions of their Cohesion, as to Magnitude, Figure, &c. The *Impetus* with which this Fluid is drove towards the Parts, will not only be at some Strokes greater than ordinary, but the Pressure upon the Blood-Vessels must be very unequal and irregular; and this will be particularly felt in those which are more easily distended, as those of the Brain, &c.

Upon this the nervous Fluid must necessarily be put into various undulatory Motions, some of which will be like those, which different Objects acting upon the Organs or Passions of the Mind do naturally excite in it; whereupon such Actions must follow in the Body, as are usually the Consequences of the several Species of Sadness, Joy, Despair, or the like Determinations of Thought.—This in some Degree is a Coagulation of the Blood, which will the more certainly happen, (when attended with uncommon Heat, as is the Case in those Countries where these Creatures abound) produce such Effects as these; because the Spirits separated from the Blood thus inflamed, and compounded of hard, fixed, and dry Particles, must unavoidably share in this Alteration; that is, whereas their Fluids consist of two Parts, one more active and volatile, the other more viscid and glutinous, which is a Kind of Vehicle to the former; their active Parts will bear too great a Proportion to the viscid; consequently they must have more than ordinary Volatility and Force, and will therefore, upon the least Occasion imaginable, be irregularly determined to every Part.—Whereupon will follow Tremblings, Anger, or Fear upon a light Cause; extreme Pleasure at what is

trivial, as particular Colours, or the like; and on the other Hand Sadness at what is not agreeable to the Sight.

The Effects of Musick on Persons touched with this Poison are brought in Confirmation of this Opinion.

As for my Part, I am rather of Opinion, that the animal Juices being obstructed in their Circulation through the Nerves, by the Poison of the *Tarantula*, and that Poison in Process of Time, reaching as far as the first Origination of the Nerves in the Brain, and thereby rendering not only the sensitive Faculty languid, but imbecillitating likewise by its Fumes and Vapours, the Imagination and Understanding, which all continue in that Lethargy 'till the Atmosphere, wherewith the Body is environed, being agitated by the repeated Strokes of Instruments, communicate its Motion to the Nerves, by the Compression thereof, the Circulation of the animal Juices being accelerated, in the repeated and violent Efforts, they are forced to make to conquer those Obstacles which obstructed their Passage; they throw the whole Machine into those Convulsions, which we mistake for Dances, and which continue 'till the whole Passage through the Nerves, from their Origination in the Brain to their Insertion in the Extremities, be free from Obstructions.—As to the Difference of Colours, it is reasonable enough to suppose, that the more they are *Desgregative*, the more they are capable to awake our Imagination from that Lethargy, the cold Fumes of the Poison it was wrapp'd in had occasioned.

Before we conclude this curious Digression, it will not be improper to take Notice, *en Passant*, of the *COCHINEAL Worm*, which is an Insect ingendered in a Fruit resembling a Pear, the Shrub which bears it is five or six Foot high. A-top of the Fruit grows a red Flower, which, when mature, falls off the Fruit; and that Opening discovers a Cleft two or three Inches in Diameter. The Fruit then appears full of little red *Insects*, having Wings of a surprising Smallness, and which would continue and die, and rot there if not taken out.

The *Indians* therefore spreading a Cloth under the Tree, shake it with Poles, 'till the *Insects* are forced to quit their Lodging and fly about the Tree, which they cannot do long, but tumble down dead in the Cloth; where they are left 'till they be entirely dry: When the *Insect* flies it is red, when it is fallen, black, and when dry, white, though it afterwards changes Colour.

The Moderns have proceeded much farther in the Knowledge of *Insects* than the Antients, as having the Advantages of the *Microscope*, which distinguishes their minute Parts, whereof they have published Draughts and Descriptions.

Audry observes, that it is wrong to call *Insects* imperfect Animals, since they want no Parts either necessary or convenient for their Use, and to render them compleat in their Kind.

Nay, some of the *Insects* are rather more perfect than the greatest Part of the other *Animals*, as it plainly appears by what I have already observed of the *Ants*, and by what I am agoing to say of the Government of the *Bees*, who, in their perfect Union, the Beauty and just Economy of their Government, their Respect for their Prince, and the Subordination subsisting among them, seem to rival the best established Commonwealth.—Perfect Strangers to all private Views or Interest, they all study nothing else but the publick Good, and the Welfare of the whole Society; Pride, Ambition, Avarice, Indolence and Idleness, are entirely banished from among them.—They all work in common, and all in common reap the Fruits of their Industry and daily Labour, which they divide among them, some keeping within the Precinct of their Walls or Hives, to lay up the Stores, which the others designed for the Quest, bring to the common Stock.—These lay down the Foundations of new Mansions, and those adorn them when built with that precious and rich Furniture, which the Maroders,

who take the Fields have gathered from the Purple of the Violets, the Scarlet of Roses, and other inimitable and beautiful Shades, which the inimitable Artist, *Nature*, has painted on the Flowers, wherewith our Fields are enamelled during the most favourable Seasons of the Year.—Some are placed at the Gates of the Metropolis, or as advanced Guards, to give the Alarm at the Approaches of their common Enemy, the *Wasp*, and hinder him from insulting their Walls; or, as Astronomers, to observe the Changes of the Heavens, and foretel the Approaches of Rain and Tempests, or to ease those who return Home overburthened with their Booty; who all set out in the Morning on their different Occupations, leaving the Care of the *Hive* to those who are past Labour, and return as well to have the Pleasure to take a Meal in Common, as to rest themselves from their Fatigues; to which they are called by those left within, sounding the Retreat, at which they all retire within their Walls, with such unanimous Consent, and quick Obedience, that it is impossible to find, after the Time fixed for that Retreat, any Strollers upon the Road.—At Night they are all wrapp'd up in so profound a Sleep, that there is not the least Noise, or Disturbance heard in their little Garrisons.

They seldom venture far from their *Hives* in rainy Weather, or when conscious of the Approaches of a Tempest; at which Time they build Bridges, or make Use of some Pebbles, as of small Vessels, on which they venture themselves, to provide Water for the whole Republic.—There are neither Temples nor Altars erected to *Venus* by the *Bees*, and the Cult of that luxurious Deity is entirely banished from among them, as contrary to the good Order of their Government, which admits of no Pleasure which could enervate their Strength, and introduce among them Luxury and Indolence.—Therefore their Progeny is propagated from the Quintessence they gather from the sweetest Flowers, not by Copulation or mutual Embraces.—They are possessed of no other Love than the innate one, they have for the Flowers which supply them with what's necessary, to perfect that *Ambrosy* and *Nectar*, which is the sole Object of their Ambition and Glory, and for which they spare not Trouble nor Labour, often expiring under their Burden.

Though the Life of the *Bee* is but of a short Duration, and seldom exceeding seven Years, they nevertheless have very numerous Families, and have the Pleasure to have been blessed before they die with a long Posterity, which they have the Satisfaction to leave behind them in a flourishing Condition, seldom departing before they have seen several Generations.

No Nation has ever been, or will ever be more dutiful to a Sovereign than the *Bees* are to theirs; for they have really a King, who is absolute Master, not of their Destiny only, but also of all their Faculties, whom they obey, without the least Reluctancy, in all he is pleased to command them.—He is the Guardian of their Work; they admire none but him, and all tremble at his single Aspect.—They are all his *Guards de Corps*; and often carry him upon their Shoulders, seldom being ambitious of any other Glory, but that of losing their Lives in his Sight, and in his Defence; for the *Bees* do not live always in the same profound Peace, as there are several Nations of them, each governed by his own King; there often arise Disputes, Jarrs, and Differences between them, which sometimes are not to be otherwise terminated but upon the Field of Battle, and then the King, who never intrusts a General with the Command of his Army, but always heads them in Person, has the Satisfaction to see his Soldiers endeavour to outvie each other in Courage, Valour, and Intrepidity; for as soon as the Onset is given, they all gather round him, as if they would make him a Rampart of their Bodies, and fight with that Discipline and Order, which would be admired among Men; the Conqueror keeping the Field of Battle, after he has defeated his Enemy, in Sign of his Victory, and both Parties taking Care of their

Dead, Wounded, &c.—Such good Order, such just Œconomy among the *Bees*, as well as among the *Ants*, which the Naturalists admire the most, because far above their Apprehension, is sufficient to refute the Sentiment of those, who suppose Insects to be imperfect *Animals*, and who are less excusable, than such as believe;

*Esse apibus partem divinæ mentis, & haustus
Æthereos* ————— Virg. Georg.

St. *Augustine* relates, that a great many scrupulous Persons in his Time, extended that Prohibition of the Law, *thou shalt not kill*, to all *Animals*; they grounded their Opinion on some Passages of Scripture,

wherein God speaks of *Animals* as if they had some Principle of Reason; declaring that he will require the Blood of Men at the Hands of Beasts, *Gen. ix.* adding in the same Place, that he makes a Covenant not only with Man, but with every living Creature. Tho', in my Sentiment, those Persons who were pleased to quote the *Genesis* to authorize their Scruple, could have found in *Deuteronomy* a great Number of Passages capable to ease their Conscience on that Point, since there, as well as in *Leviticus*, God, far from forbidding the killing of *Animals*, orders, on the contrary, they should be killed for Sacrifices, and for common Food; but those over-scrupulous Persons, had perhaps never read farther than *Genesis*.

A N T E D I L U V I A N S.

ANTE DILUVIANS are those Generations from *Adam* to *Noah's Flood*; and *Seth*, *Enoch*, &c. were the *Antediluvian* Patriarchs.

We know nothing of the *Antediluvians* but what we learn from the *Genesis*, where *Moses* seems to enter into very great Particulars, as to the Formation of the World, the Creation of Man, Beasts, &c. and to give us an exact Chronology of *Adam's* Posterity down to *Noah*, and his Posterity; whom he brings into the Ark, and where ends the *Antediluvian* Age; tho' the first grand *Epocha* of our Chronologists, which they call the Age of the Law of Nature, is continued to *Moses*, with whom the Age of the *Jewish* Law begins, and is continued to *Christ's* Birth, exclusively, where the Christian *Epocha*, or the Age of Grace begins.

The first Age according to the *Jews* consisted of 2447 Years; according to *Scaliger* of 2452; and according to *Usher*, of 2513.—The second Age according to the *Jews* consisted of 1312 Years; according to *Scaliger*, of 1508; and according to *Usher* of 1491—of the third Age there have been elapsed 1740, tho' this too is controverted by Chronologers.

Patavius will have our Saviour to have been born four Years before the vulgar *Epocha*; on which footing the current Year should be 1745; according to *Capella* 1746; according to *Baronius* and *Scaliger* 1743.

The *Romans* called the *Antediluvian* Age, the obscure and uncertain Age, and they were not much mistaken; for what they knew of it, they must have learned as we do, from the Books of *Moses*, who leave us a great many Doubts, especially as to the Age of the antient Patriarchs, which has been the Occasion of very considerable Mistakes in the *Chronology*, among all People and Nations.

Moses, 'tis true, could know nothing of it himself, but by Revelation or Tradition; if by Revelation, his Relations should be more perfect, since the supreme Wisdom must have dictated them, unless we'll chuse to say, that the great Revolutions which have happened since among the *Jews*, and their frequent Captivities, are the Reason why those Relations have not been transmitted to us so perfect, as they were written at first; besides those Errors or Mistakes may proceed from the different Copies of the Original, or from the Copies of those Copies, after the Original was lost; or at least from the Translations made of it into several Languages, different from the *Hebrew*, which had suffered many Changes and Variations among the different Nations where the *Jews* were carried Captives. If by Tradition, he must have learned what he knew of the *Antediluvians*, from his Parents in *Egypt*, who themselves might have forgotten, amidst the vexatious Oppressions of the *Egyptians*, many Particulars very essential to that History, or intermixed with the Fables and Romances of those superstitious People, since *Moses* himself is not pleased to tell us, in speak-

ing of *Noah*, that that Preserver of the human Race, had saved the Records of those Times from the general Inundation; neither can we reasonably suppose, that there were any other Records, in those Days, but a meer Tradition from Father to Son.

Those who have the Impiety to suspect the Truth of some of *Moses's* Books, particularly the *Genesis*, Part whereof, if not the Whole, they consider as a Romance, reject that Distinction between *Antediluvians* and *Postdiluvians* as chimerical, and deny absolutely the Reality of that general Flood or Inundation mentioned by *Moses*; pretending that it is an Injury offered to the divine Justice to believe, that to punish the Iniquity of a Handful of People, who had provoked his Wrath, he could have determined himself, to deface one of the most perfect Pieces of his divine Workmanship, which he had but so lately form'd of nothing, while he had in his Power, Thunder, Sword, Fire, Plague, Famine, and many other ways to punish the Guilty, without throwing Nature into the strongest Convulsions, and threatening the whole Globe with its entire Dissolution, or making it return into its former *Chaos*.—That according to *Moses* himself, those supposed Waters increased but by Degrees, and consequently those, who while *Noah* was building the Ark, neglected his salutary Admonitions, and laugh'd at his supposed needless Care, seeing the Beginning of the Accomplishment of this Prophecy, had Time to repent, and by their Repentance appease an irritated God (who has never been inflexible) and thereby stop the Progress of an Inundation. That such Repentance was not impossible, since Orthodoxy teaches at all Times, and in all Ages, that the Almighty himself, never refuses to assist powerfully therein.

But however, if it was ever so true, that those Criminals had filled up the Measure of their Iniquities, that they were grown blind and obdurate, so as to be abandoned to their reprobate Sense, what had the rest of the Creatures done, to be involved in the same Calamity? Could they have offended when they did not know how to offend? Were they less innocent than those supposed to be saved in the Ark with *Noah* and his Family? If the Earth was to be purged of the Iniquities of its Inhabitants, why was not that Purgation confined to that small Corner of it which was then inhabited? What had *Europe*, *Africa*, and the remotest Part of *America* to do with what was transacted in a very little Spot of Ground in *Asia*? Were then those Sins complained of so contagious as to have infected both Hemispheres; or rather is not the Ridicule of asserting, that Inundation universal, a sufficient Reason to suspect the Truth of it, in every Circumstance? And to make one believe that pretended fatal *Epocha* chimerical? Or that there has been no general Flood ever since the Separation of the Waters at the Beginning?

Thus

Thus speak those *Antediluvians* against the *Antediluvian* Opinion.

They would seem inclinable enough to admit of a partial Deluge or Flood, that is to say, that the first Inhabitants of the Earth being placed at the Confluent of two great Rivers, the *Euphrates* and *Tigris*, those Rivers may have overflowed their Banks all on a sudden, and surpris'd the neighbouring Inhabitants, not yet accustomed to those Sorts of Visits, and drowned Part of them; and if really designed as a Punishment, those who were the more guilty; that some of the Animals, particularly the heaviest and the most slothful, and consequently not so apprehensive of the Danger, or so ready to take to flight to avoid it, might have been involved in the same Calamity, as well as some of the Volatils, which being deprived of Food, by the Earth being overflowed, might have perished of Hunger, particularly those who by the too great Weakness of their Wings to support their Bodies, were not proper for a long Tract; as for the others who had those Advantages above the rest, no doubt but they took care of their own Preservation, by flying to those Parts of the Earth, which their natural Instinct could shew them free from the Inundation. That *Noah*, represented as a just Man, might have been inspired to precaution himself against the imminent Danger, and built the Ark for that purpose; but that they cannot imagine he was so long in building it; because we are not certain yet, what was the Year of those Times, if it consisted of twelve Months like ours; if those Months were of thirty or thirty-one Days; those Days of four and twenty-hours, those Hours of sixty Minutes, &c. or if those Years mentioned by *Moses* were not rather our Months, or our Weeks. *Celsus*, long ago, had the criminal Presumption to laugh even at the Dimensions of the Ark, as given by *Moses*, of 300 Cubits in length, 50 in breadth, and 30 in height, which compared with the great Number of Things it was to contain seem'd to him too scanty; and therefore he calls *Noah's* Ark an absurd Ark, κεισίων αλλοκοτον.—*Origen* and *St. Augustin* attempting to justify *Moses's* Dimensions, pretend that by the Cubits here spoken of, are to be understood the *Egyptian* geometrical Cubits, each of those Cubits being equal, according to them, to six vulgar Cubits or nine Foot.—To this an *Antediluvian* answers, that there was not such a Thing as a geometrical Cubit, either among *Egyptians* or *Jews*.—Others account for it by asserting, the Stature of Mankind in the first Ages to have been much greater than in our Days; and consequently the Cubit, which is taken from a Part of the human Body, proportionably larger.—Then, say they, the other *Animals* must have been larger in proportion, and consequently the same Difficulty still remains, since it is no matter how long was that Cubit, if the natural Dimensions of the Animals, which were to occupy its Vacancy, were proportioned to it.—They also turn into Ridicule, a Difference made by some between the sacred and civil Cubit, since they pretend, that there was no sacred Cubit before the Erection of the Tabernacle.

The geometrical Demonstrations of *Barco* and *Kircher*, (though admitting the Cubit to be but a Foot and a half) prove far better the Ark to have been sufficient for all the Animals supposed to be lodged therein.

Snellius computes the Ark to have been half an Acre in Area; and *Dr. Arbuthnot*, to have been 81060 Tons.—*Father L'Amey* pretends, that it was 110 Foot longer than the Church of our Lady at *Paris*, and 64 Foot narrower.

The Ark is divided by *Moses* into three Stories, each ten Cubits, or fifteen Foot high; to which *Josephus*, *Philo*, and other Commentators add a fourth, which they place under the rest, as the Hold of the Vessel to contain the Ballast, and receive the Filth and *Feces* of so many Animals.

Drexelius divides those Stories into three hundred

Apartments; *Father Fournier* into three hundred and thirty-three; and the anonymous Author of the Questions on *Genesis* into four hundred.—*Pelletier* only into seventy-two, viz. 36 for the Birds, and as many for the Beasts; his Reason is, that if we suppose a greater Number as 333, or 400, each of the eight Persons in the Ark must have had 37, 41, or 50 Stalls to attend and cleanse daily, which he thinks impossible; tho' this Difficulty, or rather supposed Inconveniency, appears to me but a very frivolous one, since it was not at all impossible, to have contrived some way whereby Part of that Filth could have been carried off by Water, without any further Trouble to *Noah* and his Family; especially as to the feathered Kind, the greatest Part whereof, are naturally inclined to avoid fouling their Nest.

All these Difficulties are started by those who favour *Moses's* Relations of the Animals brought into the Ark by *Noah*, and who suppose them incredible; if they were not to render the Ark fit for the Reception of so large a Family, or by making the Ark of a greater Extent than that described by *Moses*, or by reducing the Number of Animals contained therein. As for *Noah* taking a Couple of each Kind of Animals along with him in the Ark, it might be attributed rather to his Care for the Preservation and Subsistence of his Family, than to any Design in him, to preserve the different Species of Animals; that not knowing perhaps, the Earth to be of a farther Extent than that he was acquainted with: He thought that without such Precaution, if the Waters were to continue long upon the Face of the Earth, or if they were ever to retire into their former Bed, he and his Family must have perished for Want, had he not taken with him the Male and the Female, to propagate each Species of Animals, sufficiently for its Use; that what would be left of those Animals, if ever the Waters were to retire, would suffice, perhaps to replace those lost in the Inundation.

If these Suppositions be false, they are not, however, void of Sense and Reason; for in Fact, we want all the Assistance of an explicate Faith, to believe that there has been a general Inundation, at least such as is mentioned by *Moses*, and supported by the Authority of both the *Jewish* and *Christian* Religion. It has been always the Custom of Historians to exaggerate some extraordinary Events, which acquire a new Gloss through every Hand they pass, before they are transmitted to us. That Inundation having been the first of the Kind, when related to *Moses*, with all the Exaggerations of the Relators, might have appeared as a Prodigy to him, who had never heard of any thing like it before; and *Moses* himself, who was glad of all the Opportunities he could make Use of, to keep the stiff-necked People under his Conduct, in Awe, or by the Hope of some Rewards, or through Fear of some severe Punishment, might have exaggerated that History himself, with no other Design than to intimidate the *Jews* by the Apprehension of being treated with the same Severity, in Case they were to rebel against God, or those he appointed his Vice-gerents among them. For which *Moses* could not have been blamed, since those Things which we called *Pious Frauds*, have always proved of some Utility in all Religions, and under all Sorts of Government, though I have not the Presumption to say that *Moses's* Relation of the Flood, is of that Kind.

Men of any Religion, at all Times and in all Ages, have always represented those *Phænomena*, and extraordinary Events, as a Scourge in the Hands of the Almighty, to punish the Sins of Mankind; so that if the Sea was to overflow or break its Diques in *Holland*, and drown the whole Country, as such a Thing might very well happen without a Miracle, our Posterity, two or three hundred Years hence, could easily be persuaded, that such an Accident happened to punish the Sins of the *Dutch*; or believe, perhaps, that all *Holland* had been overflowed, when the

the Inundation had been confined to one Province, or perhaps to Part of it.

Besides, where could such a Quantity of Water have been found, to overflow the whole Earth to such a Height, so as to rise fifteen Cubits above the Top of the highest Mountains; since according to Dr. Burnet's Computation, in his *Telluris Theoria Sacra*, the Sacred Theory of the Earth, no less than eight Oceans were required to produce such *Phænomena*. Therefore, supposing the Sea quite drained dry, and all the Clouds of the Atmosphere resolved into Rain, there should have been wanted much the greatest Part of the Water for a *Deluge*.

To get clear of this Embarrass, many of our best Naturalists, as Burnet himself, Steno, Woodward, Scheuchzer, &c. adopt Des Cartes's System of the Formation of the Earth. That Philosopher considers the primitive World, as having been round and equal, without Mountains, or Vales; and accounts for its Formation on mechanical Principles, by supposing it, at first, in the Condition of a thick turbid Fluid, replete with diverse heterogeneous Matters, which subsiding by slow Degrees, formed themselves into different concentrick *Strata*, or Beds by the Laws of Gravity: And thus at length left a dry solid Earth.

Dr. Burnet improves on this Theory: He supposes the primitive Earth to have been no more than an orbicular Crust, investing the Face of the *Abyss* or Deep, which grew chinky, clave, burst, and fell down into the Water, and so drowned its Inhabitants.

The same Theorist adds, that by this Catastrophe, the Globe of the Earth was not only shook, and broke in a thousand Places, but the Violence of the Shock it then underwent, shifted its Situation; so that the Earth, which before was placed under the *Zodiack*, became thenceforth oblique to the same; whence arose the Difference of Seasons, which the *Antediluvian* Earth was not exposed to.

But I cannot see how this pretty and diverting System of the Earth, can be consistent with Moses's Relation of the Deluge, who mentions Mountains as the Standard of the Height of the Waters; had it not been more agreeable to Reason, and to the System the best *Cosmographers* have formed since of the Earth, to have denied quite, the Truth of an universal *Deluge* or Flood; then for to assert it, deny Part of Moses's History, and to have Recourse besides, to that ridiculous Supposition of Dr. Burnet, that the Earth was no more than an orbicular Crust, investing the *Abyss*? For how can this also consist with this, that the Earth was founded on its own Stability? And for what Design should the Creator have made the Earth of so brittle a Consistence, and established it on so tottering and dangerous a Foundation? Was it done on purpose to drown its first Inhabitants with more Facility, and take Occasion from thence to form a new Earth? Or is that same Crust thus sunk into the Deep, the Earth we inhabit at present? *i. e.* that Crust, bursting and breaking into Pieces, those Pieces by their Fall, acquired new and different Positions, and formed our *Plains*, *Mountains*, *Valleys*, &c. but how could that Fall make the Earth change Place, and produce that Variety and Difference in the Seasons, which the *Antediluvians* had not been sensible of? Was that *Abyss*, into which it fell, rugged, uneven, or obliquely situated? How could that be, since that Crust investing the *Abyss*, must have been parallel to it, and consequently both in the same Position; but if on the contrary, the Earth by its Shocks, shifted its Situation, there must have been a *Vacuum* to receive it; but why was not that *Vacuum* mentioned by Moses, who, when speaking of the Creation, mentions only the *Terraqueous Globe*? Perhaps the Earth then changed its Position with the Waters; and then it must have been contrary to the Laws prescribed by the Creator.

Other Authors supposing a sufficient Fund of Water in the *Abyss* or Sea, are only concerned for an

Expedient to bring it forth: Accordingly, some have Recourse to a Shifting of the Earth's Centre, which drawing after it the Water out of its Channel, overwhelmed the several Parts of the Earth successively.

For the *Elucidation* of this difficult Point, Mr. Whiston, in his *New Theory of the Earth*, has an *Hypothesis* entirely new.—He shews, from several remarkable Co-incidents, that a *Comet* descending in the Plan of the *Ecliptick*, towards its *Perihelion*, passed just before the Earth, on the first Day of the *Deluge*; the Consequences whereof would be, first, that this *Comet*, when it came below the Moon, would raise a prodigious, vast, and strong Tide, both in the small Seas, which according this *Hypothesis*, were in the *Antediluvian* Earth, (for he allows no great Ocean there as in ours) and also in the *Abyss*, which was under the upper Crust of the Earth, (for this is also a crusty Philosopher) this Tide would rise, and increase all the Time of the Approach of the *Comet* towards the Earth; and would be at its greatest Height, when the *Comet* was at its least Distance from it; by the Force of which Tide, and also by the Attraction of the *Comet*, he judges that the *Abyss* must put on an elliptick Figure, whose Surface being considerably larger than the former Spherical one; the outward Crust of the Earth, incumbent on the *Abyss*, must accommodate itself to that Figure, which it could not do while it held solid and conjoined together. He concludes therefore that it must of Necessity be extended, and at last broke by the Violence of the said Tides and Attraction; out of which the included Water issuing, was a great Means of the *Deluge*.

He shews again, the same *Comet* in its Descent towards the Sun, passed so close by the Body of the Earth, as to involve it in its Atmosphere and Tail for a considerable Time; and of consequence left a vast Quantity of its Vapours, both expanded and condensed on its Surface, a great Part of which being afterwards rarified by the solar Heat, would be drawn up again into the Atmosphere, and afterwards return again in violent Rains: And this he takes to be what Moses intimates by the *Windows of Heaven being opened*; and particularly by the *forty Days Rain*. For as to the following Rain, which with this made the whole Time of raining 150 Days, Mr. Whiston attributes it to the Earth coming a second Time within the Atmosphere of the *Comet*, as the *Comet* was on its Return from the Sun. Lastly, to remove this vast Orb of Waters again, he supposes a mighty Wind to have arose, which dried up some, and forced the rest into the *Abyss* again, through the Clefts by which it came up; only a good Quantity remained in the *Alveus* of the great Ocean, now first made, and in *lesser Seas*, *Lakes*, &c.

This *Hypothesis* supposes the Possibility of a *Comet* being brought nearer our *Vortex*, than the greatest Part of Philosophers and Astronomers can imagine, even so near as to come below the *Moon*; while Des Cartes and others suppose, that it cannot come nearer our *Vortex* than its Superficies, near the Circle of *Saturn*, at which Time it is apparent to us; which is so great a Distance, that it could make no sensible Compression on the *Terraqueous Globe*; which immense Distance can be proved, from a *Comet* appearing always without a *Parallax*, *i. e.* the Semi-diameter of the Earth, where the Diversity of the Aspect is desired, has no visible Magnitude, in respect of the Distance of the *Comet*; when on the contrary, the Moon has a very sensible *Parallax*, and is consequently the Planet nearer our *Vortex*, which Planet had better served Mr. Whiston's Purpose on this Occasion; for it was easier for him to approach the *Moon* still nearer our *Vortex*, than to bring a *Comet* for so great a Distance, on purpose to produce the different *Phænomena* of the *Deluge*; besides, I am of Opinion, the Interposition of the upper Crust of the Earth, would have been a very great Obstacle to its Attraction, since the Planets have little or no Power, but on what they have an immediate Influence; as for the answering to what

Moses

Moses speaks of the Fountains of the great Deep being broke open; I don't see how it can, or what Need we have of it to understand *Moses's* Meaning, which was certainly, that a considerable Body of Waters, assembled from the Beginning, in a Place assigned to them, by a sudden Irruption, had overflowed the Earth; and drowned its Inhabitants; which must infallibly be what he meant, since he knew very well that there was no Ocean, great or small, where that strange *Phænomenon* began; neither do I believe that he had the least Notion of thrusting a frightful Deep or *Abyss* betwixt the crustaceous Surface of the Earth, and its most solid Part; besides, to operate that Prodigy, in the Manner proposed by Mr. *Whiston*, the *Comet* must have been always at an equal Distance on our *Vortex*, for if it had followed its natural Motion, which must be the same with that of the other Planets, it had produced on the Waters of the supposed *Abyss*, the same Effect as the *Moon* on the Ocean, a reciprocal *Æstus*, or a *Flux* or *Reflux*; and therefore there had been always a Part of the crustaceous Earth dry, while the other was covered with Water, till a high Tide had broken at last the whole Crust.

That chimerical Atmosphere of the Planet, in which Mr. *Whiston*, would have had the Earth involved for a considerable Time, leaving a vast Quantity of its Vapours expanded and condensed on the *Terraqueous* Surface, on Purpose to be rarefied, and afterwards resolved into violent Rains, is well enough imagined, though those Vapours left by the *Comet's* Atmosphere, must have been left in the inferior Region of the Air; but how could a *Comet*, which is always at a greater Distance from us than any of the Planets, since as we have said already, it has no *Parallax*, and may be seen in the same Place, and near the same Stars, from *Rome*, *Constantinople*, *Paris*, &c. leave in our inferior Region condensed Vapours, to be resolved into Rain, is what Mr. *Whiston* should have also explained or demonstrated; tho' in another Sense, that vast Distance of the *Comet* could support Mr. *Whiston's* Hypothesis, since if it be true, that the higher is the Distance the Rain comes from, the larger are the Drops of Rain, Mr. *Whiston's* Rain proceeding from the Rarefaction of the Vapours left by the *Comet's* Atmosphere, the Drops of that Rain associating themselves with the Vapours of the other Planets they met with in their Way, each of them must have contained, by a very reasonable Computation, at least 100 Tons of Water; therefore it is not incredible that such Rain, continuing for 150 Days, without Intermision, might have alone caused a *Deluge*.

As for this other Part of Mr. *Whiston's* Hypothesis, that the *Comet* involved for a considerable Time, the Body of the Earth in its Atmosphere and Tail; we agree that it could have involved the Body of the Earth in its Atmosphere, if it could have passed close enough the Body of the Earth; but we reject that vulgar Opinion of *Comets* having Tails, since that supposed Tail is nothing else but the Reflection of the Light from the Atmosphere which environs the Globe of the *Comet*, and from thence conveyed to our Sight; and consequently incapable to produce any extraordinary *Phænomenon*.

Mr. *Whiston*, who at first proposed this his Opinion, as an *Hypothesis* only, has found since, that there was really such a *Comet* so near the Earth at the Time of the *Deluge*, the same which appeared again in 1688, though, mean while, the greatest Philosophers and Astronomers, cannot pretend to be certain of the Number of Years elapsed since the *Deluge*, which would be absolutely necessary to confirm and strengthen the Certitude of Mr. *Whiston's* Calculation, of the Appearance of the same *Comet* at the Time of the *Deluge*, which appeared again in 1688.

Dr. *Woodward* proves the Reality of an universal *Deluge*, by the *Exuvia* or Remains of Fishes, as their Teeth, Bones, Shells, &c. both marine and fluviatile, found in the Bodies, even in the most so-

lid *Strata*, as those of Marbles, Flints, Stones, &c. first, that these marine Bodies, and other Spoils of fresh Water Fishes, were borne forth of the Sea, by the universal *Deluge*; and on the Return of the Water back again, were left behind at Land; as we see after a vast high Tide, or some Inundation, Fishes left dead on the Shore, or in the Places where the Inundation has happened.—Secondly, that while the Flood covered the Globe, all the solid Matters, as Stones, Metals, Minerals, and Fossils were totally dissolved, and the Cohesion of their Corpuscles destroyed; and that these Corpuscles, with those of the less solid Bodies, as Earth, Flesh of Animals and Vegetables, were sustained promiscuously in the Water, and made one common Mass. Thirdly, that all the Mass thus sustained, was at length precipitated to the Bottom; and that according to the Laws of Gravity, the heaviest settling first, and the rest in Order; and that the Matters thus subsiding, constituted the several *Strata* of Stone, Earth, Coal, &c. Fourthly, that these *Strata* were originally all parallel, even, and regular, and rendered the Surface of the Earth perfectly spherical; and that the whole Mass of Water lay upon them, and constituted a fluid Sphere encompassing the Globe.—Fifthly, that after some time, by the Force of an Agent seated within the Earth, these *Strata* were broken on all Sides the Globe, and their Situation varied; being elevated in some Places, and depressed in others; whence Mountains, Valleys, Grotto's, &c. with the Channel of the Sea, its Lands, &c.—in one Word the whole *Terraqueous* Globe was put by this Disruption and Dislocation of the *Strata*, into the Condition we now behold it in.—Sixthly, that upon the Disruption of the *Strata*, and the Depressions of some, and Elevation of other Parts, which happened towards the End of the *Deluge*, the Mass of Water fell back again into the depressed, and lowest Part of the Earth, into Lakes, and other Cavities, and the Channel of the Ocean; and through the Fissures whereby this communicates with the *Abyss*, which it filled till it came to an *Equilibrium* with the Ocean.

We have no need to have recourse to an universal *Deluge*, for the Origin of these orderly *Strata*, or Layers of the Earth, mentioned by Dr. *Woodward*, if we believe with *Des Cartes*, the primitive Fluidity of the Earth; to which the different *Phænomena* mentioned by Dr. *Woodward*, might be attributed; besides the *Fossils* being found in the Womb of the Earth, and the further we proceed towards their Origin, we always discover more or less Waters, those Waters being seldom without some of the marine, or fluviatil Kind of Animals, it is very possible that those Animals may be brought into the Composition of the *Fossil*, whose first Substance is always soft, and in some Manner fluid; which do not acquire a harder Consistence, till after having been penetrated by a saline and sulphurous Liquor, and increasing in Bulk, they approach nearer the Surface of the Earth; there are even Stones which keep their former Softness, till they are digged up, and exposed to the Air, where having facated all their Humidity, they acquire their proper Hardness.

The Formation of Flints, Marbles, Stones, &c. *per Congeriem*, or *Juxta-position*, may also contribute towards our finding Remains of Fishes in their *Strata*, since those Remains might have been left in the Place of their Conformation, by some particular Inundation, drying of Marshes, &c. &c. i. e. dissolved with the Particles of the Earth they were left in, by the Spirit or Humour *Lapidifick*, and incorporated into the Substance of the Stone; all this could be done easily, without having Recourse for it to such extraordinary Event, as the Universal *Deluge*.

That those *Fossils* are generated by the *Juxta-position* of their Particles, and regenerated by the same *Juxta-position*, is evident from those Marble Quarries in *Italy*, which when emptied and filled up again, with Earth and the Fragments of the Marble, which had been digged up hence, are found to contain one

or two Centuries afterwards, as much Marble as before; and who knows but amidst those *Exuviae*, Fishes Bones, Branches of Trees, Leaves, &c. could not be found.

Mr. *De la Prime* solves the *Phænomena* attributed to the Deluge, in a Manner quite different from these heretofore mentioned. He supposes the *Antediluvian* World had an external Sea, as well as Land, with Mountains, Rivers, &c. and the Deluge was effected by breaking the subterraneous Caverns and Pillars thereof, with dreadful Earthquakes, and causing the same to be for the most Part, if not wholly absorbed and swallowed up, and covered by the Sea that we now have. Lastly, this Earth of ours arose out of the Bottom of the *Antediluvian* Sea; and in its Room just as many Islands are swallowed down, and others thrust up in their Stead.

This System is more agreeable to the Maxims of a natural Philosophy, and embarrassed with less Difficulties, or rather all the Difficulties of the others are enucleated in a clear and concise Method. It is no longer a Wonder that Shells and Shell-fish, and the Bones of Fishes and Quadrupeds, with Fruits, &c. should be found in Beds and Quarries, in Mountains and Valleys, and the very Bowels of the Earth: For here they breed in the *Antediluvian* Sea; thither they were elevated, with the Hills and Mountains, in the Time of the Deluge; there they fell into and were absorbed and buried in Chasms and Holes, and Clefts, that would certainly happen in the Extrusion of the Earth. But however, I'll rather believe the *universal Deluge*, on the simple Relation of *Moses*, than on the different Reasonings of the Naturalists, since the one is as intricate as the other, is attended with as many Difficulties, and wants as much Faith.

Dr. *Woodward* would not contradict *Moses*, as to the Reality of a Deluge, but at the same Time, contrary to *Moses's* Description, he would have at that Time, the Surface of the Earth perfectly spherical, and consequently denies tacitly this Passage, *Gen. vii. 20. Fifteen Cubits upwards did the Waters prevail, and the Mountains were covered.*

Mr. *Whiston* also agrees, that there was an universal Deluge, but he would have it caused by a Comet being brought on the Superficies of our *Vortex*, and the violent Rains to proceed from the Vapours of the Atmosphere of that Comet, being resolved into it by the Heat of the Sun; though *Moses* meant by the Windows of Heaven being open, the Irruption of those Waters he had placed above the Firmament, *Gen. i. 7. And God made a Firmament, and divided the Waters which were under the Firmament, from the Waters which were above the Firmament.* Which Waters have never been found there since, by any Astronomer whatever.

Therefore I would agree in every Particular with *Moses*, or reject entirely *Moses's* Relation, as *hyperbolic*; which cannot be done without denying the Truth of the sacred Text. Though if I was to consult my Reason alone, which in Matter of Faith, is seldom to be done, I could not persuade my self that the Deluge was universal, and that from that particular one, which happened for the Punishment of a few Criminals, none but *Noah's* Family was saved, or that so small a Family could have increased afterwards to such a Degree, as to have been capable to people the whole Earth: Which seems to imply a very great Contradiction, even when we consult the sacred Text itself. For though there were but sixteen Generations between them and *Abram* or *Abraham*, and the first of each Generation lived a great many hundred Years after he had begat his first Son, so long, perhaps, as to see the seventh or eighth Generation, and therefore *Shem* could have informed his Children, Grand-children, Great Grand-children, &c. of what had happened in his younger Days (as he

must have done with respect to the Deluge) and in particular of his two other Brothers, what was become of them with their Family, in what Part of the World they were settled, &c. And nevertheless *Abraham* and his Family, which was but the sixteenth Generation from *Shem*, when they went into *Canaan*, and from *Canaan* into *Egypt*, don't seem so much as to have the least Notion of those People, from whence they came, who was their first Parent or Founder; though according to the Text, they should have all sprung from the same Source, and not so long since, neither, as to be quite out of theirs or of *Adam's* Mind. How could we then depend on the Relations of those Times, for *Noah's* Descendants having overspread the whole Earth, since so near the Time of their Separation, their own Descendants don't seem to have known it themselves; and the Nations who inhabited those Parts so near the Place of their Separation, are considered by *Abraham* and his Family, as a quite different Sort of People, entire Strangers to them? The *Egyptians* were a formidable People, their Monarchy very well established, and pretended to reckon a considerable Succession of their Kings, when *Abram* came among them with his Family, which did seem then like a new Race, newly began the World; though *Abraham* was descended in a direct Line from *Shem*, one of *Noah's* favourite Sons, to whose Posterity a particular Blessing seemed to have been annexed.

But however, if the *Egyptians*, *Canaanites*, and the other Nations, which inhabited those Parts of the Earth, were the Descendants of *Noah's* other two Sons, *Ham* and *Japheth*; which of their Descendants were sent to people the rest of the Earth? Which of them into *Europe*, into *Africa*, or *America*: This last Part having been known, but some thousands of Years since? which Way could have they been transported into those great Isles of the eastern and western Seas, which, when first discovered, were found overstock'd with Men, since the Art of Navigation was entirely unknown to them? Unless we chuse to say, that at the Time of the Deluge, some of *Adam's* Descendants had fled, to avoid the general Inundation, to the farthest Extremities of the Earth, and dividing themselves by Tribes, or Families, each of those Families had fixed itself in that Part of the World, which they found suited them best; and in that case there would be still upon Earth some *Antediluvian* Nations; which being but a Supposition may be rejected as contrary to the sacred Text.

The History both sacred and prophane, makes mention of divers other Deluges: That which happened in *Greece* in the Time of *Deucalion* is famous. This Deluge only overflowed *Thessaly*; its Date is fixed to the Year before *Christ* 1529, being the third Year before the *Israelites* coming out of *Egypt*, according to the Computation of *Palavius*, *Rat. Temp. p. I. l. 2. c. 7.* the ancient Poets fancied also, that Deluge universal, and the Earth wholly deprived of its Inhabitants, *Deucalion* excepted, which they have re-peopled by *Deucalion's* throwing Stones over his Shoulders, which Stones were metamorphosed into Men.

The Deluge of *Ogyges*, happened near 300 Years before that of *Deucalion*, 1020 Years before the first *Olympiad*, and 1796 before *Christ*, according to the same Author, *Rat. Temp. p. I. l. 1. c. 4. p. II. l. 2. c. 5.* This only ravaged *Attica*.

These two Deluges are frequently mentioned in ancient *Greek* Authors, under the Denomination of *Cataclysmus Prior*, and *Posterior*.

Of the like Kind were those Inundations in the *Netherlands*, which in 1277, overwhelmed and covered with Sea, all that Part now called the *Gulph Dollart* in the *United Netherlands*, and in 1421, all that Part between *Brabant* and *Holland*.

ANTICHRIST.

ANTICHRIST, from the Greek *αντι*, *contra*, against, and *Χριστος*, *Christ*, taken in a general Sense denotes an Adversary of *Christ*, who denies that the *Messiah* is come, as the *Jews*; and all the Religions opposite to Christianity, as *Infidels*, *Turks*, &c. but however the Name of *Antichrist* is more particularly adapted to an Impostor, or Tyrant, who is to appear on Earth towards the End of the World, and even seduce, if possible, the People elect.

St. *John* in his *Apocalypse* speaks of the *Antichrist*, as of a great Beast, with seven Heads and ten Horns, to whom the Dragon gives his Power, and is to continue forty and two Months upon Earth, Rev. xiii. 5. the Marks he is to be known by, according to the said Evangelist, are, that he'll speak Blasphemy against God, his Name, his Tabernacle, and them that dwell in Heaven; that he'll make War with the Saints and overcome them. That all that dwell upon Earth shall worship him, whose Names are not written in the Book of Life of the Lamb slain from the Foundation of the World, &c.

The *Roman* Catholick Authors when they speak of *Antichrist*, represent him as a Son of Perdition, born from an Incest or Sacrilege; for some of them pretend that he is to be the Offspring of the sacrilegious Amours of a *Monk* and of a *Nun*; that he'll be train'd up in all Sorts of Vices, Crimes and Iniquities; that by his Craft and Hypocrisy, he'll find the Secret to gain an infinite Number of Profelytes, by whom he'll be worshipped, and over whom he'll usurp a tyrannical Power and Authority. That with their Assistance, he'll endeavour to extend his Domination with Fire and Sword. That the most zealous of his Partisans will be the *Jews*, whom he'll gain to his Party, under the captious Promise of restoring them to their pristine Splendor and Glory, by reinstating them in the Possession of those fertile Provinces, from which they had been so long banish'd. That Morality, Piety and Religion are to retreat before him, and that Christianity will be once again put to a Fire of Probation. That the Sanctuary is to be then once more polluted, and the Altars of the living God dy'd with the Blood of his Sacrificators; that Innocence, Equity, Probity, and Justice, will be sacrificed to his Ambition, and that some *Elias*'s will be then once more heard to complain, that they are the only ones left in *Israel*, who have not bowed their Knees to *Baal*. That Sacrilege, Rapine, Murder, Incest, Rapes, will then cover the Face of the Earth, and be left unpunished; and that the most formidable Powers of the Earth will support the Usurpation of the new Tyrant.

A great many of the Fathers have supposed in their Times, especially when they considered the Depravation of the Manners of the greatest Part of the Christians, that the Reign of *Antichrist*, was near at Hand, such Supposition was not without some Foundation, at the Time when the Impostor *Mahomet* began to preach his monstrous Doctrine, which he promoted in the same Manner that *Antichrist* is to do his. The *Antichrist* is to promise his Profelytes, a Felicity wholly wrapt up in Sensuality and Luxury, so did *Mahomet*. He is to operate by the Force of a magick Art, a great many Wonders and Prodigious to surprize the credulous Ignorance of his Followers, so did *Mahomet*; he is to pretend to the Gift of Miracles, and Prophecy, which was the most efficacious Method *Mahomet* employed to gain the Admiration and servile Respect of his Partisans.

The sole Difference between the *Antichrist* and *Mahomet* is, that *Antichrist*'s Reign, is to last but three Years, according to the Fathers Opinion, and that of *Mahomet* has lasted already several Centuries, in a too flourishing State.

Some of the Protestant Writers have apply'd to the *Roman* Church, and to the *Pope*, in particular, who is the Head of it, the several Marks and Signatures of the *Antichrist*, enumerated here. Mr. *Jurieu*, a *French* Minister Refugee in *Holland*, went even so far as to fix the Duration of the Reign of this *Antichrist*, which was to be but short, after which the *French* Refugees were to return into their own Country, and re-enter into Possession, as well of the free Exercise of their Religion, as of the Estates they had abandoned for it; but it happened unfortunately for them, that Mr. *Jurieu* had been mistaken in his Ephemerides; since the Time fixed by him for that happy *Epocha*, has been elapsed long since, without any such Revolution; Mr. *Jurieu* himself, who, according to his Calculation, was to see those Days of the Lord, being dead without it; leaving the *French* behind him to mourn so great a Disappointment.

One of his Brethren, *Armand du Bourdieu*, another *French* Minister, Refugee here in *London*, used also to represent the *Pope* as the *Antichrist*, and the late King of *France*, *Lewis* XIV. as his Lieutenant, to whom he apply'd (not always I must confess thro' a very great Principle of a Christian Charity) all these Passages of the *Apocalypse*, ix. 11, 12, 15, 16, 17. that he was another Beast who spoke like a Dragon.—That he caused as many as would not worship the Image of the Beast to be killed.—That he caused all, both small and great, rich and poor, free and bond, to receive a Mark in their Right-hand, or in their Forehead. And that no Man might buy and sell, save he that had the Mark, or the Name of the Beast, or the Number of his Name. Thereby intimating, that those of his Brethren, whom he consider'd as the Faithful of the *Apocalypse*, who would not worship, or receive the Marks of the Beast (the *Pope*) were to be killed by the other Beast, the King of *France*.

But if his Zeal, which his very Audience has often considered as a Fanatic one, was agreeable to a Christian Meekness, Patience, and Charity, or to that of the Faithful, who, in the latter Days, are to encounter with the *Antichrist*; if the Pulpit design'd for the Predication of the Gospel, is to be turned into a *Rostrum*, to excite Nations to Revenge, Animosity and Rebellion, is what the most sensible, and the most Christian-like Part of the *French* Refugees are better Judges of. All that I can say to it, is, that the Prophecies of those two modern Prophets, are contradictory of what has been foretold of the *Antichrist*, since the *Antichrist* is only to appear towards the latter End of the World, and his Reign is to last no longer than three Years, and the *Pope* has appeared, even at their own way of reckoning ever since *Constantine the Great*, and his Reign lasted ever since without Interruption, *i. e.* longer than that of those who were sent to put an End to it; as well as to that of his pretended Lieutenant *Lewis* XIV. who reigned longer than any other Prince before him. That there is still this other great Difference between the Reign of the *Pope* and that of the *Antichrist*, and between the Faithful of his Time, and the supposed ones persecuted by the *Pope*; that the Reign of the *Pope* has preceded those persecuted by him, and those of the latter Days are to precede the Reign of *Antichrist*.

Tho' it must be said to the Honour of the *French* Refugees of our Days, that they have quite renounced that Fanatick Zeal of their Ancestors; that we hear no more their Churches echo with Invectives against Sovereigns and crown'd Heads, whom they are convinced at present to be God's Vicegerent upon Earth; and have learned from the Apostles to obey and respect them. That the Zeal of their present Pastors

is truly apostolical, and such as becomes the Ministers of *Christ*, who have no other Care or Attention than how to modelize the Manners of the Flock committed to their Care, by the good Shepherd himself, on the truly christian Charity, and Simplicity of the primitive Christians, and to inspire them with a just Gratitude for a Prince, under whose Protection they live happier than they could expect to be in any other Part of the World, and for a generous, noble, liberal and compassionate Nation, who has received their Ancestors with open Arms, and provided profusely all that could make them forget, that they were Fugitives; in a Word, to *Jurieu, Du Bourdieu*, and other Fanatick Zealots, have succeeded those truly apostolick Men, *Mainard, Aufrere, Barnouens, Le Blanc, Pourdellon, &c.* capable themselves to oppose by their exemplary Life, and Piety, the Progress of the real *Antichrist*, who, they know very well, has not appeared yet. For though I condemn, with the rest of the Christian World, the too great Magnificence and Splendor of the Court of *Rome*, who in that very Particular, has much deviated from the Primitive Simplicity of the Christian Church, I cannot believe it a Mark of the *Antichrist*, since the Tribe of *Levi*, under what Denomination soever, has always been accused of Ambition and Pride; and it is inferred from thence, that all other Clergy would appear with as much Pomp, if they could, since every one does it in his Manner, and as far as the Restraint put to it by prudent, discreet and wise Nations will permit; which, however, have not yet reformed enough the *Levitic* Pride, since they should have made it one of the distinguishing Marks of the *Antichrist*, for a Priest to ambition any Thing else besides the Kingdom of Heaven, or to take upon themselves any other Care than the Conduct and Instruction of their Flock.

It is true that the *Pope*, in Spite of the *Apocalypse*, and of all the Fathers of the Church, was declared *Antichrist* at an Assembly of *French* Protestants at *Gap* in *Provence*, in 1603: but it is as false what some Authors pretend, that *Henry IV.* then King of *France*, was mortified to be thus declared an Imp of the *Antichrist*, for if he took any Notice of it, it was only in his jocular Humour, and in Derision, for *Henry* was a very good and a very great Prince, one of the best who ever ascended the *French* Throne, but he was not bigotted enough to any Religion to be sensible to the grossest Affront offered to it; besides I scarcely believe he minded much the Decisions of such Assembly; which he had too much Wisdom to consider as an Œcumenical Council, especially since the Conference of *Fontainebleau*. *Clement VIII.* himself, then *Pope*, and consequently the supposed *Antichrist*, far from being stung to the Life, as pretended, expected no better Treatment from that Assembly.

My Opinion is, that the Want of Charity on all Sides, (not the *Holy Ghost*) inspir'd all the Assemblies, held in those Days, *Pro* and *Con*, in Matters of Religion; and that if our Ancestors had been as wise, and as moderate as we are on that Subject, if they had really followed the Advice of *Christ*, and contented themselves to pray in Private, when their Princes would not allow them to do it in Publick, there had never been so much Christian Blood spilt, and the *Pope* had never been stigmatized for an *Antichrist*; but too much Animosity on both Sides, has caused all those Disputes, Altercations and Divisions in the Church, and prepared Matter of Laughing to the Enemies of Christianity; for in such Case all other Christians as well as the *Pope* are *Antichrists*, especially when they draw their Swords to propagate a Religion, which our *Divine Saviour* intended should be done, by the Meekness, Patience, and Resignation of its Professors. I hate as much to hear Christians, or those who call themselves such, rave against the *Pope*, and reproach him with being the *Antichrist*, as I do to see him at *Rome* environed with his Guards, and worshipped as a *Pagan* Divinity.

The Emperor *Caligula*, was also an *Antichrist*, at

least in *Grotius's* Opinion, in which he was as much mistaken, as the *French* Protestants, since his *Antichrist* don't quadrate, neither with the common Opinion, that *Antichrist* is not to appear but towards the latter End of the World; *Julian the Apostate*, called by some of the Fathers *Primogenitus Diaboli*, the first-born of the Devil, must have been also an *Antichrist*; and I am surpris'd that *Cromwell* has not been stigmatized with it, considering that some charitably inclined Christians could have found in him some of the Marks of the *Antichrist*, as those of usurping a Regal Power, making Profelites *Vi & Armis*.

Father *Malvenda*, a *Spanish* Jesuit, has published a learned Work, *de Antichristo*, in thirteen Books.— In the first he relates all the Opinions of the Fathers, with regard to *Antichrist*. In the second he speaks of the Time when he shall appear, which must be very near at Hand, since he pretends that it will be, when Religion, Virtue, Piety, Probity, Integrity, Justice, Sincerity, and true Friendship, will be entirely banished the Earth, to make Room for Atheism, Impiety, Perfidy, Avarice, Corruption, Luxury, Injustice, Murther, Revenge, Animosity, Venality, Simony, and all the other Vices, which are to accompany *Antichrist* at his first Appearance in the World, and to compose his Retinue. In the third he discourses of his Origin and Nation, and shews that he is to be a *Jew* of the Tribe of *Dan*: This he founds on the Authority of the Fathers; on that Passage in *Genesis* 49. *Dan shall be a Serpent by the Way*. On that of *Jeremy* viii. 16. where 'tis said, *the Armies of Dan shall devour the Earth*; and on the *Apocalypse*, chap. vii. where *St. John*, enumerating the Tribes of *Israel*, makes no Mention of that of *Dan*. In the fourth and fifth Book he treats of the Signs of *Antichrist*. In the sixth of his Reign and Wars. In the Seventh of his Vices. In the Eighth of his Doctrine and Miracles. In the Ninth of his Persecutions: And in the Rest of the coming of *Enoch* and *Elias*, the Conversion of the *Jews*, the Reign of *Jesus Christ*, and the Death of *Antichrist*, after having reigned three Years and a half.

In Effect, *Enoch* and *Elias* having been ravished from the Earth, while its Face was almost covered with the Iniquities of its Inhabitants, one under the Law of Nature, and the other under that of *Moses*, without having been Subjects to the common Fate of Mankind, Death, have made the Christian Fathers (who have wrote of *Antichrist*) suppose that these two just Men were kept by the Almighty in some Place hidden from us, on Purpose to appear at the latter Days, to oppose and fight *Antichrist*, whom they would conquer at last; though they are divided in their Opinion, if *Enoch* and *Elias* are to survive *Antichrist*, or die before him. The most common Opinion being that they will survive him.

The *Franciscan* Friars join their Patriarch or Founder, *St. Francis*, to these two holy Champions, under the Supposition that some holy Personage should also appear in the Field, in the Defence of the Law of Grace, and that there was all the Reason imaginable to believe that *God* had preserved *St. Francis* upright, and entire as he is in his Tomb, rather as if in an Extasy than dead, for that Purpose; and that all three, after the Death of *Antichrist*, would in Concert establish the Reign of *Christ* upon Earth.

This Reign of *Christ*, which is to succeed that of *Antichrist*, and which in some Fathers Opinion, is to be of 1000 Years Duration, for want of its being very well understood, has also caused some Division in the Church, and in all Probability has been the Occasion of an Error, which began in the Primitive Church, that *Jesus Christ* was to come again, and reign on Earth for the Space of a thousand Years; during which Time the Faithful were to enjoy all Manner of temporal Blessings, and at the Expiration of that Time the Day of Judgment was to take Place.

This Opinion, attributed to *St. Papias*, as the Author thereof, was followed, says *Mr. Laurus*, by the

greatest Men among the Primitive Fathers; as *Irenæus*, *Justin Martyr*, *Tertullian*, &c. and was held for near three Centuries, e'er it was charged as erroneous. *Dionysius of Alexandria* and *St. Jerom* oppos'd it very strongly, as contrary to the Scripture, which makes no Mention of that imaginary Reign, but on the contrary, speaks no otherwise of the second *Avenement of Christ*, but as he is to come then, only to judge both the Quick and the Dead; it being repugnant to his divine Nature, he should communicate with Mortals, otherwise than as a glorified Body.

The Opposition of those Fathers, and the *Anathema's* of the Church, smothered for a considerable Time the Error of the *Millenaries*, which was reviv'd afterwards with more Warmth than before, though under another Form: For these new *Millenaries*, supposing that the first Opinion was defectuous, in that it was not consistent with the glorified Body of *Christ*, should dwell so long among Mortals; the uncorruptible with the corruptible, they pretended that the Reign mentioned in the *Apocalypse*, was not to begin, but after the general Resurrection, when *Christ* should reign 1000 Years upon Earth with the Just, at the

Expiration whereof he would carry them along with him into Heaven.

John XXII. Pope, is suspected to have been of that Opinion, made Use of by the Enemies of the Church of *Rome*, as of an Argument; against the Infallibility of that Church; to which the Partisans of that Church answer, that on that Occasion, *John XXII.* thought, and spoke like a private Person, and could be then subject to err, but not as a Pope, since there was no Bull promulgated in Defence of his Opinion on that Subject.

In 1707, there was a strong Rumour in *France*, that the *Antichrist* had appeared in some of the Southern Provinces of that Kingdom; nay, that false Rumour prevailed so far, that some Impostors affirmed they had seen him, and gave such a frightful Description of his Person, that all the devout old Women were affrighted out of their Wits; but however, that Imposture had some good Effect, for the most zealous *Preachers* took Occasion from thence to exhort People to Repentance; and when the most piously disposed of the *French* were ready to encounter with *Antichrist*, he disappeared, and, as I suppose, has never been heard of since.

ANTIQUITIES.

ANTIQUITIES, in the Sense they are taken in this Place, are all antient Temples, Obelisks, Pyramids, Columns, Amphitheatres, Mausoleums, or Tombs, Ruins, Statues, Sculptures, Paintings, Inscriptions, Hieroglyphicks, Manuscripts, Medals, Urns, and Mummies; and in general all curious Pieces, that may afford any Light into Antiquity.

Temple, *Templum*, from the old Latin, *Templare*, to contemplate, is a public Edifice, erected in Honour of some Deity, either true or false, and wherein the People meet to pay religious Worship to the same.

Clemens Alexandrinus, and *Eusebius* refer the Origin of Temples to the Sepulchres built for the Dead. — *Herodotus* and *Strabo* will have the *Egyptians* to have been the first who built Temples to their Gods, which were nothing else but Figures or Representations of Quadrupeds, Fishes, Reptils, or Insects. They have at the *Post-House*, at *Lions* in *France*, built in the Wall, on the Left Hand in entering the Gate, the Figure of a Snake, in Stone, with some Hieroglyphicks, which they pretend to have been an *Egyptian* Divinity. — *Apollonius* ascribes the first Temple erected in *Greece* to *Deucalion*. — But at present there remains not the least Vestiges of those antient Edifices.

The *Romans* out-did all Nations in the Point of Temples; for they not only built Temples to their Gods, (of which they had a long Train) to their *Virtues*, to their Diseases, &c. but also to their Emperors, and that in their Life-Time. — *Horace* compliments *Augustus* hereupon, and sets him above *Hercules*, and all the Heroes of Fables; in that those were only admitted into Temples after their Death, whereas *Augustus* had his Temples and Altars while living.

*Presenti tibi maturos largimur Honores;
Jurandasque tuum per Nomen, ponimus Aras.*

Epist. ad August.

There was so great a Number of those Sorts of Temples, and of several other Kinds at *Rome*, that there are yet many of them to be seen in and without that Metropolis of the World; some entire, some half-ruinated, and others with only their first Foundations, or Vestiges.

Among the Rest there is none so celebrated, so compleat, and so perfect as the *Pantheon*, at present

called our Lady of the *Rotunda*, since it appears almost in its original State, with Respect to the Edifice, but stripp'd of all its Statues, and other Decorations. Some are of Opinion that it was erected by *Marcus Agrippa*, about the 14th Year of *Christ*; but others are apt to believe that the Body of the Temple was built in the Time of the Republick, and that *Agrippa* added only the Portico to it.

This Temple was called the *Pantheon*, either because, after *Jupiter*, it was dedicated to all the Gods; or, as others are of Opinion, because it is circular, or bears the Figure of the World. — The Height of it from the Floor to the Opening at the Top (from whence it receives all its Light) is the Diameter of its Breadth from one Wall to another.

Amongst the most celebrated Things, which we read were in this Temple, were the Ivory Statue of *Minerva*, by *Phidias*, and that of *Venus*, which had the one half of that Pearl for an Ear-ring, whereof *Cleopatra* dissolved the other half, and drank it at Supper to exceed the Liberality of *Anthony*. This half only of that Pearl was valued, as is reported, at 250,000 Ducats.

This whole Temple both without and within was of the *Corinthian* Order. — It has a most beautiful Portico in Front, on the Frieze whereof is this Inscription:

M. Agrippa. L. F. Cæs. III. fecit.

Under it, that is, in the Fascias of the Architrave, is the following Inscription in smaller Letters, which shews that the Emperors, *Septimius Severus*, and *Marcus Aurelius* repaired this Temple consumed with Age.

*Imp. Cæs. Septimius. Severus. Pius. Pertinax.
Arabicus. Particus. Pontiff. Max. Trib. Pot.
XI Cof. III. P. P. Procos. & Imp. Cæs. Marcus.
Aurelius. Antonius. Pius. Felix. Aug. Trib.
Pot. V. Cof. Procos. Pantheon Vetusate.
Cum. omni. Cultu. restituerunt.*

In the Thickness of the Wall, within the Temple, there are seven Chapels with the Niches, wherein there must have been Statues of Course; and a Tabernacle between one Chapel and another; so that there are in all eight Tabernacles. Some are of Opinion that Pope *Boniface*, who first consecrated this Temple

Temple to divine Service, added that in the Middle, over-against the Entrance, in Order to have one particular Altar larger than all the Rest, and that because the Arch of that Chapel breaks into some of the Columns of the second Order; but by its agreeing perfectly well with the Rest of the Work, and having all its Members excellently finished; others believe, that it was made at the same Time with the Rest of the Temple.

Near the Trophies of *Marius* is seen a Fabrick, also of a circular Figure like the Pantheon, which some take for a *Basilica*, which, together with a noble Portico, *Augustus* caused to be erected in Commemoration of *Caius* and *Lucius*, his Grand-Children, from whence 'tis supposed that it is at present vulgarly called *La Galluce*; but others are of Opinion that it was a Temple, because it has none of those Parts which are absolutely necessary in *Basilicas*.

It is all Brick-work, which must have been incrusted, no doubt, with Marble, but is now all taken away. The middle Nave, which is perfectly circular, is divided into ten Parts, and in each of them there is a Chapel incased in the Thickness of the Wall, except in that where the Entrance is, the two Naves on the Sides must have been curiously embellished, because they contain such a Number of Niches; and in all Probability there were Columns and other Decorations in them.

The Parts of this Structure supporting one another, it must be prodigiously strong; since though so very antient, it is still standing.

Near the *Senatorial* Bridge, at present *St. Mary's*, is seen an antient Temple, almost whole and perfect, which some suppose to have been that of *Fortuna virilis*, or *Manly Fortune*, whereof this Miracle is upon Record, that being in a Flame with every Thing in it, the gilded wooden Statue, which was erected there by *Servius Tullius*, was the only valuable Part that was not damaged.

The Decorations of the Door of the Temple are very curious, and have an excellent Proportion. This whole Temple is built of *Peperino*, covered with *Stucco*.

Near this Temple there is another round one, called at present *St. Stephens*. Historians tell us that it was built by *Numa Pompilius*, and dedicated to the Goddess *Vesta*. He would have it circular like the Globe of the World, whereby Mankind subsists, and whereof the said *Vesta* was the Goddess.—This Temple is of a *Corinthian* Order.

Besides these antient Temples, which are yet to be seen standing, there are also at *Rome* several Ruins of others; such as those of the Temple of *Peace*, near the Church of *Santa Maria Nova*, in the sacred Way.

Historians tell us that it is in the self-same Place, where the *Curia* of *Romulus* and *Hosilius* was at first, and afterwards the House of *Melius*, the *Basilica Portia*, the House of *Cæsar* with its Portico; which *Augustus* demolished, appearing a Building, in his Opinion, too great and magnificent; but he erected another there, which he called after the Name of his Wife, *Livia Drusilla*.

The Emperor *Claudius* began this Temple, and *Vespasian* finished it, after he returned victorious from *Judea*, depositing all the Vessels and Decorations of the Temple of *Jerusalem* therein, which he carried in Triumph. The Temple was, as we are informed, the greatest, the most magnificent, and the richest of the whole City: And doubtless its Remains, even ruined as they are, represent so much Grandeur, that we may easily form an Idea of what it was when whole and entire.—The Walls of this Temple were adorned with Statues and Pictures, and every Part of it was extremely beautiful.—It was burnt in the Time of the Emperor *Commodus*.

Near the *Torre de Conti* may still be seen, the Ruins of the Temple which had been erected by *Augustus* to *Mars the Avenger*, pursuant to a Vow he had made, when he and *Mark Anthony*, to be re-

venge of the treacherous Murder of *Julius Cæsar*, fought the Battle of *Philippi*, against *Brutus* and *Cassius*, and conquered them.

By the Remains of this Temple we may plainly discern, that it was a most beautiful and stupendous Fabrick, and much the more marvellous by the Splendor reflected upon it from the *Forum* just before it; into which, we are told, those who returned Victors, and triumphant into the City, carry'd the Trophies of their Enemies, and other Marks of their Victory.

In the finest Part of it *Augustus* placed two very exquisite Pieces of Painting, one a Battle Piece, and the other a Triumph. As also two others drawn by *Apelles*; one representing *Castor* and *Pollux*, the Goddesses *Victory* and *Alexander*; and the other, another Battle Piece.—There were two Portico's, where *Augustus* dedicated the Statues of all such who had returned triumphant to *Rome*.

Near this Temple are the Traces of that of *Nerva*, in the Front of the Architecture whereof, the few Letters following may still be seen, tho' very imperfect, and defaced by Time.

IMPERATOR NERVA. CÆSAR AVGVSTVS. PONT. MAX. TRIB. POT. II. IMPERATOR II. PROCOS.

In a Square before this Temple was erected the Statue of *Nerva* on Horse-back. The Decorations of the Square were so many, and so admirable, that it caused the Admiration of the Spectator.—When the Emperor *Constant* came to *Rome*, the rare Structure of this Edifice surprised him in the most agreeable Manner; and then, turning to his Architect, said, that he would have a Horse like that made at *Constantinople*, to eternize his own Memory; to which the Architect answer'd, That a Stable like that, pointing to the Square, should be made first, to receive the Horse.

Between the *Capitol* and Mount *Palatin*, near the *Roman Forum*, are three Columns of the *Corinthian* Order, which, some say, were Part of the Temple of *Vulcan*; and according to others of the Temple of *Romulus*; and others, that these Columns, together with those below the *Capitol*, were part of the Bridge made by *Caligula's* Directions, for passing from the Mount to the *Capitol*.

At the Foot of the *Capitol* are some Traces of a Temple, consecrated to *Jupiter the Thunderer*, by *Augustus*, for his Deliverance from an imminent Danger in the *Cantabrian* War, when in an Expedition, he made by Night, his Litter was pierced through with an Arrow; by which Accident a Slave, that was just before him, was killed, and he preserved unhurt.

Also at the Foot of the *Capitol*, not far from the Arch of *Septimius* (where the *Roman Forum* began) may be seen the Columns of the Portico of a Temple, which was erected by *Furius Camillus*, and according to some dedicated to *Concord*. The publick Affairs were frequently here debated, and we may reasonably conclude, that this Temple was dedicated to that Service; since the Priests would not permit the Senate to convene about State Affairs, except only in the consecrated Temples, and such only were consecrated as were erected by the Directions of the *Augurs*; for which Reason, and on Account of their debating in such Places on Government Affairs, this sort of Temples were also called *Curie*.

Among many Statues with which this Temple was embellished, some Historians mention that of *Larona*, holding *Apollo* and *Diana*, her Children, in her Arms; as also the Statue of *Æsculapius* and his Daughter *Hygieia*, or Health; those of *Mars*, *Minerva*, *Ceres*, *Mercury*, and that of *Victory*, placed in the Front of the Portico, and Thunder-struck in the Consulship of *Marcus Marcellus*, and *Marcus Valerius*.—By what may be collected from the following Inscription, which still remains on the Prize; this Temple was destroyed by Fire, and afterwards re-edified.

edify'd by the Direction of the Senate and People of Rome.—The Words are these,

S. P. Q. R. INCENDIO CONSUMPTVM RESTITVIT.

i. e. the Senate and People of Rome rebuilt this Temple consumed by Fire.

Over-against the Temple of *Mars the Avenger*, in a Place called *in Pintano*, behind *Marforio*, stood formerly a Temple, the Foundations whereof were discovered, as some Workmen were digging in order to build a House, and which by the Dolphins carved on the *Cymasium* of its Cornice, and since in some Places between the Dolphins, there are Tridents, we suppose was consecrated to *Neptune*.

The Temples, which the Romans had erected to their false Divinities, were not confined to Rome alone, there was a great Number of them throughout Italy, and all the Provinces of the Empire.

At *Tevoli* about sixteen Miles from Rome, at the Fall of the River *Anien*, now called *Teverone*, is seen a Temple of the *Corinthian* Order, which was erected to *Vesta*, though the Inhabitants of the Place pretend, that it was the Habitation of the *Tiburtin Sibyl*.

There is the Portico of a Temple at *Naples*, below the Square of the Palace and the Vicary, erected to *Castor* and *Pollux*, by *Tiberius Julius Tarsus*, and by *Pelago Augustus*, as appears by its Inscription in the following Greek Characters.

ΤΙΒΕΡΙΟΣ ΙΟΥΛΙΟΣ ΤΑΡΣΟΣ ΚΟΥΡΟΙΣ ΚΑΙ ΤΗ ΠΟΛΕΙ
ΤΟΝ ΝΑΟΝ ΚΑΙ ΤΑ ΕΝ ΝΑΩ.
ΠΕΛΑΓΩΝ ΣΕΒΑΣΤΟΥ ΑΠΕΛΕΥΘΕΡΟΣ ΚΑΙ ΕΠΙΤΡΟ-
ΠΟΣ
ΣΙΝΤΕΛΕΣΑΣ ΕΚ ΤΩΝ ΙΔΙΩΝ ΚΑΙ ΘΙΡΟΣΕΝ.

The Signification whereof is, that *Tiberius Julius Tarsus*, began to erect this Temple and all the Things there- to belonging, in Honour of the Sons of *Jupiter* (*Castor* and *Pollux*) and to the City, and that *Pelago* perfected it at his own Expence, and consecrated it.—In the Front is a Sacrifice carved in *Basso Relievo*, by a most excellent Artist.—The whole Portico is of the *Corinthian* Order.

Some are of Opinion, that there were two Temples in this Place, the one circular, and the other square; but there remains no Foot-steps of the former, and the latter, in the Opinion of the best Architects, is modern.

At *Pola*, a City of *Histry*, there are two Temples on the same Side of a Square, of equal Dimensions, with the same Decorations, and distant from each other fifty-eight Feet four Inches.—On the Frize of the Front is the following Inscription;

ROMÆ ET AVGVSTO CÆSARIS INVICT.
D. PAT. PATRIÆ.

Among many other curious Remains of Antiquity, they have at *Nismes* in *Languedoc*, the native Country of the Emperor *Antoninus Pius*, a Temple, which the Inhabitants call, *La Maison quarée*, or the square House, because built in a quadrangular Form.

They have another which they suppose to have been the Temple of *Vesta*, which cannot be, since it must be observed that all the Temples dedicated to *Vesta* were made circular, after the Form of the Earth, whereof she was reputed to be the Goddess, and because the Passages on three Sides of this Temple were inclosed with Walls, wherein were the Doors to the Sides of the Cell, and the Door of the Nave itself in the Front, so that it could receive no Manner of Light from any Quarter; now, as no Reason can be assigned why dark, and gloomy Temples should be consecrated to *Vesta*, *Antiquaries* believe it a Temple of some infernal Deities.

Several Persons who are not the best *Connoisseurs* in *Antiquities*, and even the Romans themselves, mistake often Temples for publick *Basilicas*, or publick Places,

built by the Antients for the Administration of Justice, or for the Transaction of Affairs of the greatest Importance, (that built at Rome, by *Paulus Emilius*, between the Temples of *Saturn* and *Fauskina*, on which he expended 1500 Talents, was the most sumptuous, and the most magnificent that ever has been built of the Kind) or for private ones, which were the dwelling Places of Persons of the highest Rank and Distinction among the Romans; it must be observed here, in Order to be capable of making a judicious Difference between both; that the antient publick *Basilicas*, of which there are not the least Traces or Remains to be seen at Rome, or any where else, as well as the private ones, had no Capitols, as the Temples had, and had *Porticos* in the Inside, and the Temples without. Therefore our Churches are more like the antient *Basilicas*, than like the antient Temples, since they have their *Portico's* within; because, perhaps, the primitive Christians being used to meet, for Fear of the Gentiles, in the *Basilicas* of private Persons, found afterwards that this Form was very convenient for a Church, because the Altar could be placed instead of the Tribunal, to great Advantage; and that the Choir could stand round the Altar in good Order, while the remaining Part might hold the People.

All Temples built since the Ruin of the Roman Empire, are not considered as Pieces of Antiquity, even the most antient Christian Temples, are by all Architects represented as modern Buildings.

In Antiquity we meet with many People who would not build any Temples to their Gods, for fear of confining them to too narrow Bounds. They performed their Sacrifices in all Places indifferently, from a Persuasion that the whole World was a Temple of God, and that he requires no other.—This was the Doctrine of the *Magi*, followed by the *Persians*, the *Scythians*, the *Numidians*, and many other Nations mentioned by *Herodotus*, lib. 1. *Strabo*, lib. 15. and *Cicero*, in his second Oration against *Verres*.

The *Persians*, who worshipped the Sun, believed it would wrong his Power, to inclose him in the Walls of a Temple, who had the whole World for his Habitation: And hence, when *Xerxes* ravaged Greece, the *Magi* exhorted him to destroy all the Temples he met with.

The *Sicyonians* would build no Temples to their Goddesses *Coronis*; nor the *Athenians* for the like Reason erect any Statue to *Clemency*, who they say was to live in the Hearts of Men, not within Stone-Walls.

The *Bithynians* had no Temples, but the Mountains to worship on, nor the antient *Germans* any other but the Woods.

Even some Philosophers have blamed the Use of Building of Temples, particularly *Diogenes*, *Zeno*, and his followers the *Stoicks*.—But it may be said, that if God have no Need of Temples, Men have Need of Places to meet in for the publick Offices of Religion; accordingly Temples may be traced back even into the remotest Antiquity, as we had done it.

I do not know if I may venture to place under this Article of Temples, a famed Pile or Monument of huge Stones on *Salisbury* Plain, six Miles distant from that City (which consists of the Remains of four Ranks of rough Stones, ranged one within another, some of them, especially in the outermost and third Rank, twenty Feet high, and seven broad; sustaining others laid a-cross their Heads and fastened by Mortises, so that the whole must have antiently hung together) since *Antiquaries* are divided as to the Origin, Use, Structure, &c. of this wonderful Fabric.

Some of them take it to have been an antient Temple of the *Druids*; others, of the *Romans*, dedicated to *Cælus*; in which they are confirmed by its having been opened a-top.—Others, reading the Name *Stone-Hengist*, maintain it to have been a Monument erected in Memory of *Hengist*, the first General of the Saxons in England.—Others will have it a funeral

neral Monument, raised to that brave *Romano-Briton*, *Aurelius Ambrosius*; to which Opinion, some Circumstances of his Actions, the still remaining Latin Name of the Place, *Mons Ambrosii*, and that very antient Welsh Proverb, *Mal gwaith Emrys*, like the Work of *Ambrose*, give some Countenance; though Dr. *Langwisch* thinks it might easily be made probable, at least, that it was a Temple dedicated to the *Sun* and *Moon*.

Y. *Straken*, *Stone-Henge*, a Temple restored to the British *Druids*.

Inigo Jones has given a fine Scheme of the Work, and strives hard to persuade the World that it was *Roman*; but Dr. *Langwisch*, who took his Measures on the Spot, assures us, he could by no Means reconcile them with that Scheme.

The AMPHITHEATRES, from the Greek, ἀμφι, about; and θέατρον, Theatre, are another Kind of antient publick Edifices, of which there are still some standing at *Rome*, *Pola*, *Nismes*, *Douay*, &c.

The *Amphitheatres* were a spacious Building of an oval Figure, having its *Area* or *Arena*, encompassed with Rows of Seats, rising gradually one above another; with Portico's both within and without Side.

The *Amphitheatres* were appointed for the exhibiting of Spectacles or Shews to the People: As the Combats of *Gladiators*, and those of wild Beasts; and as the *Theatres* of the Antients were built in Form of a Semi-circle, only exceeding by one fourth Part of the Diameter; the *Amphitheatres* were nothing else but a double Theatre, or two Theatres joined together; so that the longest Diameter of the *Amphitheatre*, was to the shortest, as $1\frac{1}{2}$ to 1.

The *Amphitheatre* at *Pola*, an antient Republick of *Istria*, is very intire, consists of two Orders of *Tuscan* Pillars, one over the other.—The lower has Pedestals, which is extraordinary; this Order having scarce ever more than Bases to support them.

The *Amphitheatre* of *Titus* is computed to have been capable of holding 85000 Spectators.

That of *Verona*, is one of the best preserved; for though most of the best Stones of the Outside are picked out, yet the great Vault, on which the Rows of the Seats are laid, is entire: The Rows also, (which are forty-four in Number) are entire. Every Row is a Foot and a Half high, and as much in Breadth; so that a Man sits conveniently in them; and allowing for a Seat a Foot and a Half, the whole will hold 23000 Persons.

The most entire of all those, now standing, is that of *Douay*, a small Town, upon the Confines of the Provinces of *Anjou*, and *Poitou*, in *France*; it don't want so much as a Stone, and could contain, by Supputation, 25000 Spectators.

There is also, a very magnificent *Amphitheatre* at *Nismes*, in *Languedoc*; and some Remains of *Amphitheatres* at *Arles*, *Bordeaux*, &c.

We have not the least Traces of them remaining in *England*; though our natural Inclination for the Spectacles represented on the *Amphitheatres*, persuade me, that in the Times of the *Romans*, a great many Edifices of that Kind had been erected here among us; and if our Ancestors have not been so careful of those Monuments of *Antiquities*, as other Nations, it can be attributed to nothing else, but to their *Seraphick* Zeal, and great Fervour for the Christian Religion, when it was first preached among them, which could not allow them to see standing in a Land, stiled at that Time the *Nursery of Saints*, any Thing which could call to their Mind, that they had been guilty of worshipping false Divinities. Christianity having found the Secret to reform in them, that savage and barbarous Humour, which made them delight in Blood, and in the Slaughter of their fellow Creatures and Countrymen; a brutal Diversion, so absolutely contrary to the Principles, not only of a true Religion, but likewise of Humanity itself; and if those cruel and barbarous Pastimes have been since revived amongst us, 'tis a Sign that we have as much deviated from the Piety of our Ancestors, as from their noble Compas-

sion and Humanity. I consider those who flock to *Figg's* or *Stokes's Amphitheatre*, to *Pagans* disguised under the Mask of Christianity, and would flock with the same Zeal to the *Bacchanalia*, or other heathenish Feasts, if such superstitious Cult was to meet with the same Toleration.

We are grossly mistaken, if we believe that our taking Pleasure in those Sorts of Spectacles, is a Sign of our natural Bravery and Intrepidity, since a true Valour is always accompany'd with Humanity, and sets too high a Price on human Blood, to be pleased to see it trifled with.

Not that I question the Bravery of the *English* Nation, since it would be the greatest Piece of Injustice I could be guilty of, and for which I should be condemned by all other Nations; but I would have that brave and precious *English* Blood preserved for a better Occasion, and never have it spilt but in the Defence of one's Country.

Even in this we surpass the antient *Romans* in Cruelty, since their *Gladiators* were nothing else but Slaves, who fought of Necessity; or Captives appointed to fight with each other, and do their best to save their own Life, by killing their Adversary.

Junius Brutus, who expelled the *Tarquins*, is said to have been the first who honoured the Funeral of his Father with these inhuman Diversions.—They were at first perform'd near the Sepulchre of the Deceased, or about the Funeral-pile (they being first instituted instead of the Sacrifices of Captives, or Prisoners of War, offer'd at first to the Manes of the great Men who had died in an Engagement) but were afterwards removed to the *Circus* and *Amphitheatres*, and became ordinary Amusements.

The Emperor *Claudius* restrained them to certain Occasions; but he soon afterwards annulled what he had decreed, and private Persons began to exhibit them, at Pleasure, as usual; and some carry'd the brutal Satisfaction so far, as to have them at their ordinary Feasts; and not Slaves only, but other Persons would hire themselves to that infamous Office.

The Master of the *Gladiators* made them first swear that they would fight to death; and if they failed therein, they were put to death, either by Fire, Swords, Clubs, Whips, or the like.

It was a Crime for the Wretches to complain when they were wounded, or to ask for Death, or seek to avoid it when overcome; but it was usual for the Emperor, or the People, to grant them Life, when they gave no Signs of Fear, but waited the fatal Stroke with Courage and Intrepidity. *Augustus* decreed that it should always be granted them.

From Slaves and freed Men, the wanton Sport spread to People of Rank and Condition; and *Nero* is related to have brought upwards of four hundred Senators, and six hundred *Roman* Knights upon the *Arena*; tho' *Lipsius* takes both these Numbers to be falsified, and not without Reason, reduces them to forty Senators and sixty Knights; yet *Domitian*, that other Monster of Cruelty, refined upon *Nero*, exhibiting Combats of Women in the Night time.

The Combats of *Gladiators* were first forbidden in the East by *Constantine the Great*, who, by an Order to the *Præfatus Prætorii*, dated at *Berytus* in *Phœnicia*, the 1st of *October*, 325, and still extant, condemn'd the Criminals employ'd therein to the Mines.

The Practice was not entirely abolished in the West before *Theodoric*, King of the *Ostrogoths*; though the Emperor *Honorius* had first forbidden them at *Rome*, on Occasion that St. *Thelemachus*, at the Time of one of these Spectacles, for endeavouring to dissuade the *Gladiators* from continuing the Sport, had been stoned to Death by the Rabble; but that Prohibition does not seem to have been executed 'till the Year 500, when it was entirely abolished by the said *Theodoric*.

Programma's, or Bills, were distributed among the People, some Time before the Day of Battle, by the Persons who gave the Shews, containing the Names of the *Gladiators*, and the Marks whereby they were to be distinguished, for each had his several Badge, which

which was most commonly a Peacock's Feather, as appears from the Scholiast of *Juvenal*, on the 158th Verse of the third Satyr.—They also gave Notice what Time the Shews would last, and how many Couples of *Gladiators* there were; and it even appears from the 52d Verse of the seventh Satyr of the second Book of *Horace*, that they sometimes made Representations of these Things in Painting; as is practised among us by those who have any Thing to shew at Fairs.

The Day being come, they began the Entertainment by bringing two Kinds of Weapons; the first were Staves, or wooden Foils, called *Rudes*; and the second effective Weapons, as Swords, Poniards, &c.—The first were called *Arma luforia*, Arms for Diversion; the second *Decretoria*, as being given by Decree, or Sentence of the *Prætor*; or of him at whose Expence the Spectacle was exhibited.—They began to fence or skirmish with the first, which was to be the Prelude to the Battle; from these when well warm'd, they advanced to the second with which they fought naked.—The first Part of the Engagement was called *ventilare, præludere*, to prelude; and the second *dimicare ad certum, or versis armis pugnare*; and some Authors think, with much Probability, that it is to these two Kinds of Combats, that St. Paul alludes in the Passage 1 Cor. ix. 26, 27. 'I fight not as one that beateth the Air; but I keep under my Body, and bring it under Subjection.'

If the Vanquish'd surrender'd his Arms, it was not in the Victor's Power to grant him Life; it was the People during the Time of the Republick, and the Prince or People during the Time of the Empire that were alone impowered to grant the Boon.

The Reward of the Conqueror was a Branch of Palm-tree, and a Sum of Money; sometimes they gave him his *Congé*, or dismissed him; by putting one of the wooden Foils or *Rudes* in his Hand; and sometimes they even gave him his Freedom.

The Sign or Indication whereby the Spectators shewed that they had granted the Favour, was, to fall the Thumb, or clench it between the other Fingers; and when they would have the Combat finish'd, and the Vanquish'd slain, they raised the Thumb, and directed it towards the Combatants; which we learn from *Juvenal*, Sat. iii. 36.

The *Gladiators* challenged or defied each other by shewing the Little-finger; and by extending this, or some other during the Combat, they own'd themselves vanquish'd and begg'd Mercy from the People.

There were divers Kinds of *Gladiators*, distinguish'd by their Weapons, Manner of Fighting, &c. as the *Catervati*, who fought in Troops or Companies, Number against Number.—*Cubicularii*, who fought in private Houses during Feasts.—The *Dimacheæ*, who fought arm'd with two Poniards or Swords, or with Sword and Dagger.—The *Essedarii*, who fought in Carrs; called also in an Inscription, lately discover'd at Lyons, *Affedarii*.—The *Fiscales* or *Cæsariani*, who belonged to the Emperor's Company, and who being more robust and dexterous than the rest, were frequently called for; and therefore named *Postulatii*.—The other Kinds were, the *Hoplomachi*, *Meridiani*, *Mirmillones*, *Ordinarii Provocatores*, *Retiarii*, *Rudiarii*, *Secutores*, *Speculatores* and *Thraceæ*.

There was another Kind of Building, in Antiquity, for the exhibiting Shews to the People, called *Circus*, from the *Latin*, *Circuitu*, or from *Circe*, to whom *Tertullian* attributes the Invention.

The *Roman Circus* was a large oblong Edifice, arch'd at one end, encompass'd with Portico's, and furnished with Rows of Seats, placed ascending over each other.—In the Middle was a Kind of Foot-bank or Eminence, with Obelisks, Statues, and Posts at each End. This served them for their Courses of their *Bigæ* and *Quadrigæ*—*Bigæ* were Chariots drawn by two Horses a-breast; *Trigæ*, by three; *Quadrigæ*, by four, &c.

There were no less than ten *Circus's* at Rome; the largest was that built by the elder *Tarquin*, called *Circus Maximus*, between the *Avantine* and *Palatine* Mount. *Pliny* says it was enlarged by *Julius Cæsar*, so as to take in no less than three *Stadia* in length, and one in width.

The most magnificent *Circus's* were those of *Augustus* and *Nero*.—There are still some Remains of the *Circus's*, both at Rome, at *Nismes*, and other Places; but as they used to encompass a too large Spot of Ground, and were not built for so long a Duration, Time has defaced them.

The Games of the *Circus*, which some call *CIRCENSEAN GAMES*, were Combats celebrated in the *Circus*, in Honour of *Consus* the God of Councils, and thence also called *Consualia*.—They were also called *Roman Games*, either on Account of their Antiquity, as being coeval with the *Roman* People, or because established by the *Romans*.

These Games were instituted by *Evander*, and re-established by *Romulus*; the Pomp or Procession, called *Pompa Circensis*, was only a Part of the Games, making the Prelude thereof, and consisting of a simple Cavalcade of Chariots.—Till the Time of the elder *Tarquin*, they were held in an Island of the *Tiber*; and were called *Roman Games*: After that Prince had built the *Circus*, they took their Name therefrom, as being constantly held there.

There were six Kinds of Exercises in the *Circus*; the first Wrestling, Fighting with Swords, Staves, and Pikes; the second was Racing; the third *Saltatio* Dancing; the fourth Disciquoits, Arrows, and *Cestus*, and which were on foot; the fifth was Horse-courfing; the sixth Courses of Chariots, whether with two Horses or with four; each bearing the Names of the Colours they wore.—At first there was only White and Red; then Green was added and blue. *Domitian* added two more Colours, but they did not hold.—It was *Ænomaus* who first invented this Method of distinguishing the Quadrils by Colours. The Green was for those who represented the Earth; the Blue for the Sea, &c.

The great Games, called *Ludi Magni*, were held in Honour of the God *Neptune*, who was the *Romans Consus*, and not of the *Sun*; as some have imagined.

Other antient Edifices were the *Agora's* or Squares of the *Greeks*, and the *Forums* of the *Romans*.—The *Roman Forums* differ'd from the *Grecian Agora's*, and were of a square Form, surrounded with spacious and double Porticoes and thick Columns.—These Porticoes or Piazza's were as broad as the Columns were long; so that by their being double, the Place for walking was as spacious as twice the Length of a Column, which made it very commodious.—Over the first Columns, were others a fourth Part less than the first; these had under them a *Corridor* of such Height as was most convenient, because these upper Porticoes were appointed likewise for walking and discoursing, and for Persons to stand commodiously therein, to be Spectators of any Shews that might be exhibited in the Square, either out of Pleasure or Devotion.—All these Porticoes must of Course have been embellish'd with Niches and Statues, since the *Greeks* used to be highly delighted with such Sort of Ornaments.—Near to these Squares were the *Basilica*, the Senate-house, the Prisons, &c.

But the *Roman Forums*, or Squares, were somewhat longer than they were broad; so that dividing the Length into three Parts, two made the Breadth; because the *Gladiators* exerting their Skill publicly in these Places, this Form was more commodious for their Purpose than a perfect Square; for which Reason likewise the Intercolumnation of the Porticoes, that went round the Square, was made of two Diameters and Quarter of a Column, or even of two Diameters, that the Sight of the People might not be intercepted by the Thickness of the Columns.—The Porticoes were as broad as the Columns were high, and

and under them were the Bankers and Goldsmiths Shops.—The upper Columns were a fourth Part less than the under ones, because all Pieces below should be stronger than those above, considering the Weight they bear.—In the Part fronting the warmest Region of Heaven were the *Basilicas*.—On that Side which fronted the North, stood the Senate-house, a Square and a half in Length. This *Curia*, or Senate house, was the Place where the Senate assembled to consult about State Affairs.

Of these *Forums* there were several at *Rome*; at first only three, viz. *Romanum*, *Julianum*, and *Augustum*; but that Number was afterwards increased to six, by the Addition of the *Transitorium*, called also *Palladium*; the *Trajanum* and *Sallustii Forum*.—The first and most eminent of these was the *Forum Romanum*, called also *Forum Vetus*, old Square; and absolutely *Forum*, or the *Forum*.—In this was an Apartment called the *Rostra*, where the Lawyers pleaded; the Officers harangued; Funeral Orations delivered, &c. —This *Rostra* was adorned with the Beaks of Ships taken from the People of *Antium*, in a naval Engagement, whence the Name.

The Antients were also very curious in building Columns. Of which there were various Kinds, viz. Historical, Chronological, Funeral, Instructive, Itinerary, Lactary, Legal, Limitrophous or Boundary, Manubriary, Memorial, Menian, Milliary, Military, Statuary, Symbolical, Triumphal and Zoophorick.

The *Historical Columns* were those whose Shafts were adorned with a *Basso Relievo*, running in a spiral Line its whole Length; and containing the History of some great Personage. Of these Kind are the *Trajan* and *Antonine Columns* to be seen still at *Rome*.

That of *Trajan* is of the *Tuscan Order*, though somewhat irregular; its Height is eight Diameters, and its Pedestal *Corinthian*; it was built in the *Forum Romanum*, or *Roman Square*.—Its Base consists of twelve Stones of an enormous Size, and it is raised on a Socle, or Foot of eight Steps. Within-side is a Stair case illuminated with forty-four Windows. It is 140 Foot high, which is 35 Foot short of the *Antonine Column*; but the Workmanship of the former is much more valued. It is adorn'd from top to bottom with *Basso Relievo's*, representing the great Actions of that Emperor (one of the best who ever fought under the *Roman Eagles*) against the *Dacæ*.—Several learned Men have explain'd the Bas Reliefs of the *Trajan Column*, and among others *Ciacconius* and *Fabretti*.—The late King of *France*, *Lewis XIV.* had Models of all those Bas Reliefs taken off in Plaster of Paris.

The *Antonine Column* has 199 Steps, with 56 Windows; and each of these is divided by Tambours of white Marble.

At *Athens* there were *Chronological Columns*, whereon were inscribed the whole History of *Greece*, digested into *Olympiads*, those Sorts of Columns being erected for no other Use, than to bear some historical Inscription, digested according to the Order of Time; as by *Lustres*, *Olympiads*, *Fasts*, *Epochas*, *Annals*, &c.

The *Funeral Columns* had sometimes their Shafts overspread with Tears or Flames, which are Symbols of Grief, and of Immortality; and were erected to support an *Urn*, wherein were inclosed the Ashes of some deceased Hero.

We do not learn from Historians that there were ever more than two *Instructive Columns*, one, which *Josephus*, lib. i. cap. 3. pretends to have been erected by the Sons of *Adam*, whereon were engraven the Principles of Arts and Sciences; and another supposed by *Baudelot* to have been raised by the Son of *Pisistratus*, containing the Rules and Precepts of Agriculture.

Pestus informs us, that at *Rome*, in the Herb-market, now the Place *Montanara*, was erected a Column called *Lactary*, which had a Cavity in its Pedestal, wherein young Children, abandon'd by their Parents,

out of Poverty or Inhumanity, were exposed to be brought up at the publick Expence.

None but the *Lacedemonians* have ever erected *Legal Columns*, whereon were engraven the fundamental Laws of their State; and those Columns were always erected in publick Places, for the better Instruction of the People.

Alexander, according to *Pliny*, erected a *Limitrophous* or *Boundary Column* at the Extremities of the *Indies* to shew the Limits of his Conquests; and the *Romans* afterwards follow'd his Example.

The *Romans* were very industrious in erecting *Manubriary Columns*, built in Imitation of Trees, and adorn'd with Trophies, whereon they hung the Spoils of the Enemies.

Suetonius and *Ascanius* refer to a certain *Menias* the Origin of the *Menian Column*, who having sold his House to *Cato* and *Flaccus*, Consuls, to be converted into a publick Edifice, reserved to himself the Right of raising a Column without side, to bear a Balcony, whence he might see the Shews.

Augustus had a Column of white Marble (the same with that which is now seen on the Balustrade of the *Perron* of the Capitol at *Rome*) erected in the Middle of the *Roman Forum*, which was called *Milliary*, and from whence, as a Centre, the Distances of the several Cities, &c. of the Empire, were reckoned by other *Milliary Columns*, disposed at equal Distances on all the grand Roads. This Column was called *Milliarium Aureum*, as having been gilt, at least the Ball, by Order of *Augustus*.—Its Proportion is massive, being a short Cylinder, the Symbol of the Globe of the Earth.—It was restored by the Emperors *Vespasian* and *Adrian*; as appears by the Inscriptions.

The *Romans* had two Sorts of *Military Columns*, one whereon was engraven a List of the Forces of the *Roman Army*, ranged by *Légions* in their proper Order; with Design to preserve the Memory of the Number of Soldiers, and of the Order observed in any military Expedition.—And another called *Columna Bellica*, standing before the Temple of *Janus*, (whose Gates were always open in time of War, and shut in time of Peace) at the Foot whereof the Consul declared War, by throwing a Javelin towards the Enemy's Country.

The Columns adorn'd with the Beaks or Prows of Ships and Galleys, with Anchors and Graplers, erected either in Memory of a naval Victory, as the *Tuscan Column* in the Capitol, or in Honour of some Admiral, were called *Rostral Columns*.

There was dug up in the Temple of Peace, I have heretofore mentioned, a flatted Column of the *Corinthian Order*, whose Shaft is a single Block of white Marble, 49 Foot and a half high, and five Foot eight Inches Diameter; which *Paul V. Pope*, had erected on a Pedestal, before the Church of *St. Maria Major*, at *Rome*, to support a Statue, of gilt Brass, of the *Virgin Mary*, from whence 'tis called a Statuary Column, as all other Columns which support a Statue.

The *Caryatides* and *Termini* were also a Sort of Statuary Columns.—The *Caryatides* were, and are still, a Kind of Order of Columns or Pilasters, under the Figures of Women, dressed in long Robes, serving to support Entablatures.—*Vitruvius* pretends, that the Origin of *Caryatides* is owing to the *Greeks* having taken the City of *Garia*, led away their Women Captives; and to perpetuate their Servitude, represented them in their Buildings, as charged with Burdens, such as those supported by Columns.

Termes, or *Termini*, (from the *Roman God Terminus*, the *Protector* of Land-Marks) was a Statue made without Hands or Feet (that he might not change his Place) planted at the Bounds of Lands to separate them.—The two famous Statues of *Pasquin* and *Marforio* at *Rome*, might be ranked among these Sorts of Statues, since otherwise, I do not know where else to place those two great Satyrists, who for several Centuries have, by their witty *Repartees*, diverted all *Europe*.

Pasquin

Pasquin is a mutilated Statue at *Rome*, in a Corner of the Palace *Ursini*.—It takes its Name from a Cobler of that City; called *Pasquin*, famous for his Sneers and Gibes; and whose Shop was the Resort of a Number of idle People, who diverted themselves with bantering Folks as they passed by.—After *Pasquin's* Death, as they were digging up the Pavement before his Shop, they found a Statue of an ancient *Gladiator*, well cut, but maimed, and half-spoiled. This they set up in the Place where it was found, at the Corner of the deceas'd Master *Pasquin's* Shop; and by Consent, called it by the Name of the Defunct.—From that Time all Satires and Lam-poons are ascribed to this Figure, are put in its Mouth, or pasted against it; as if they came from *Pasquin Redivivus*.—*Pasquin* usually addresses himself to *Marforio*, another Statue in *Rome*; or *Marforio* to *Pasquin*, whom they made reply.—The Answers are usually very short, poignant, and unlucky: When *Marforio* is attacked, *Pasquin* comes to his Assistance; and *Pasquin* is assisted by *Marforio* in his Turn, *i. e.* the People make the Statues speak just what they please.—The Dialogues between these two Statues are called *Pasquinades*.

We have no visible *Pasquins* here in *England*, but we have some invisible ones, who act their Part, to the full as well, as ever did the *Roman Pasquin*, and their *Pasquinades* are often seasoned with more *Attic* Salt.

There was another Kind of *Statuary Columns*, called *Zoophoric*, whereon was placed a Figure of some Animal, as that at *Sienna*, which bears the Wolf which suckled *Romulus* and *Remus*; and one of the two Columns (though not a Piece of Antiquity) whereon is the Lion of *St. Mark*, and the Arms of the Republick.

The *Symbolical Columns* represented some particular Country, by the Attributes proper thereto, as the *Corvinian Column*, on which was a Crow, erected to *Valerius Maximus*, surnamed *Corvinus*, in Memory of his defeating a Giant in the Army of the *Gauls*, by the Assistance of a Crow.—And the modern one, of the *French Order*, set with *Flowers de Luce*, on the Frontispiece of the *Jesuits Church* at *Rouen*, in *Normandy*.

The *Triumphal Columns* were erected by the Antients, in Honour of a Hero; the Joints of the Stones, or Courses whereof, were covered with as many Crowns as he had made different military Expeditions.—Each Crown had its particular Name; as *Vallis*, which was beset with Spikes, in Memory of having forced a Pallisade. *Muralis*, adorned with little Turrets, or Battlements (which Sort of Crowns have Place at present in our *Blazon*) for having mounted an Assault. *Navalis*, of Prows and Beaks of Vessels, for having overcome at Sea. *Obsidionalis*, or *Graminalis* of Grass; for having raised a Siege. *Ovans*, of *Myrtle*, which expressed an Ovation or little Triumph; and *Triumphalis*, of *Laurel*, for a grand Triumph.—*Procopius* tells us of a Column of this Kind erected in the Place, called *Augustum*, before the Imperial Palace at *Constantinople*, supporting an Equestrian Statue of the Emperor *Justinian*.

OBELISKS and PYRAMIDS were also raised by the Antients, as an Ornament in some publick Places, and frequently charged with Inscriptions and Hieroglyphics.

The PYRAMIDS, from *πυρ*, was a solid massive Edifice, which from a square, triangular, or other Base, rose, diminishing to a Point or *Vortex*.—They were sometimes erected to preserve the Memory of singular Events; and sometimes to transmit to Posterity the Glory and Magnificence of Princes; but as they are the Symbols of Immortality, they were more commonly used, as funeral Monuments; as that of *Cestius* at *Rome*, and those other celebrated ones of *Egypt*, as famous for the Hugeness of their Size, as for their Antiquity.

The OBELISKS, from *obelos*, a Spite, Branch, or Spindle, were, and are still, triangular Pyramids,

very slender and high.—The Difference between *Obelisks* and *Pyramids*, according to some, consists in this, that the latter have large Bases, and the former very small ones, though *Cardan* makes the Difference to consist in this, that *Obelisks* are to be all of a Piece, or to consist of a single Stone, and *Pyramids* of several.

P. Kircher reckons up 14 *Obelisks*, celebrated above the Rest; *viz.* that of *Alexandria*, that of the *Berberins*, those of *Constantinople*, of the *Mons Esquilinus*, of the *Campus Flaminius* of *Florence*, of *Helicopolis*, of *Ludovisio*, of *St. Mabut*, of the *Medici*, of the *Vatican*, of *Marcus Cælius*, and that of *Pamphilia*.—The first *Obelisk* we know of, was that raised by *Rameses*, King of *Egypt*, in the Time of the *Trojan War*. It was 40 Cubits high, and according to *Herodotus*, employed 20,000 Men in the Building.—*Phicis*, another King of *Egypt*, raised one of 45 Cubits; and *Ptolomy Philadelphus* another of 88 Cubits, in Memory of *Arfinoe*.—These three *Obelisks* are of *Porphyry*, and still standing.—*Augustus* erected an *Obelisk* at *Rome*, in the *Campus Martius*, which served to mark the Hours on an horizontal Dial, drawn on the Pavement.

This Kind of Monument, which is very antient, was first made Use of, we are told, to transmit to Posterity the principal Precepts of Philosophy, which were engraven in hieroglyphical Characters hereon.—In after Times they were used to immortalise the Actions of Heroes, and the Memory of Persons beloved.

The antient Statues are divided by *Antiquaries* into *Greek* and *Roman Statues*, and these again subdivided into *Divine*, *Heroes*, and *Augusti*.

The *Greek Statues* were naked Figures; being in this Manner they represented their *Deities*, *Athletæ*, of the Olympic Games, and *Heroes*; the Reason of this Nudity was, that those who exercised Wrestling, wherein the *Grecian Youth* placed their chief Glory, always performed naked.—The *Greeks* succeeded in their Statues beyond the *Romans*; both the Workmanship, and the Fancy of the *Roman Statues* were inferior to the *Grecian*; indeed we have very few remaining that have escaped the Injuries of Time.

The *Roman Statues* differed in this from the *Grecians*, that they were cloathed; those of the Emperors with long Gowns over their Armour, and hence were called *Statue Paludatæ*; those of Captains and Cavaliers, with Coats of Arms, *Thoracatæ*; those of Soldiers with Cuirasses, *Loricatæ*; those of Senators and Augurs, *Trabeatæ*; those of Magistrates with long Robes, *Togatæ*; those of the People with a plain *Tunica*, *Tunicatæ*; and, lastly, those of Women with long Trains, *Stolatæ*.—Their other Division of Statues is that I have already mentioned into *Divine*, which were those consecrated to the Gods, as *Jupiter*, *Mars*, *Apollo*, &c. *Heroes*, which were those of the *Demi-Gods*; as *Hercules*, &c. and *Augusti*, which were those of the Emperors; as those two of *Cæsar* and *Augustus*, under the Portico of the Capitol.

The other Kinds of Edifices which the Antients used to adorn or embellish their Cities or Towns with were *Triumphal Arches*, *Baths* and *Bridges*.

The TRIUMPHAL ARCHES were Gates or Passages into a City, built of Stone or Marble, Sculpture, Inscriptions, &c. serving not only to adorn a Triumph, at the Return from a victorious Expedition, but also to preserve the Memory of the Triumph to Posterity.—The most celebrated Triumphal Arches now remaining of Antiquity are that of *Titus*, of *Septimus Severus*, and of *Constantine* at *Rome*.—One of the Gates of *Orange* (the chief City of that Principality belonging antiently to the illustrious House of *Nassau*, but at present in the King of *France's* Possession) is a Triumphal Arch of *Caius Marius*.—The Gate, *Peyro*, at *Montpelier*, is also a Triumphal Arch; and the Gates of *St. Denis*, *St. Martin*, and *St. Antoine* at *Paris*, though modern Pieces, deserve that Name.

BATHS were large and pompous Buildings, which made

made Part of the antient *Gymnasia*, and which, tho' erected for the Sake of bathing, were frequented more for the Sake of Pleasure, than Health.

The most magnificent *Baths* were those of *Titus*, *Paulus Æmilius*, and *Dioclesian*, of which there are some Ruins still remaining.——It is said that at *Rome* there were 856 public *Baths*. *Fabricius* adds, that the excessive Luxury of the *Romans* appeared in nothing more visible than in their *Baths*. *Seneca* complains that the *Baths* of *Plebeians* were filled from silver Pumps; and that the freed-Men trod on Gems. *Macrobius* tells us of one *Sergius Oratus*, a Voluptuary, who had pendant *Baths* hanging in the Air.

Since I have hinted here at *Gymnasium*, I am obliged to inform the Reader, that it was a publick Edifice of the Antients, erected for performing Exercises of the Body, where People were taught, and regularly disciplined therein.

The *Romans* borrowed the *Gymnasia* from the *Athenians*, and the *Athenians* from the *Lacedæmonians*; since *Solon*, in *Lucian's Anacharsis*, and *Cicero de Orat. l. 2.* are both of Opinion, that the *Greeks* were the first that had *Gymnasia*.

There were three principal *Gymnasia* at *Athens*; the *Academy*, where *Plato* taught; the *Lyceum*, noted for *Aristotle's* Lectures; and the *Cynosarges*, allotted for the Populace.

Mr. *Burette*, after *Vitruvius*, asserts, that the *Gymnasia* consisted of twelve Members or Apartments, viz. 1. The exterior Portico's, where the Philosophers, Physicians, Mathematicians, Rhetoricians, and other Virtuoso's read publick Lectures, disputed, and recited their Performances. 2. The *Ephebeum*, where the Youth assembled very early, to learn their Exercises in private, without any Spectators. 3. The *Corycum*, *Apoditerion*, or *Gymnasterion*, a Kind of Wardrobe where they stript, either to bathe or exercise. 4. The *Elæothesium*, *Alipterion*, or *Unctuarium*, appointed for the Unctions which either preceded or followed the Use of the Bath, Wrestling, *Pancrasia*, &c. 5. The *Conisterium*, or *Conistra*, in which they covered themselves with Sand or Dust, to dry up the Oil or Sweat. 6. The *Palæstra*, properly so called, where they practised Wrestling, the Pugilate, *Pancrasia*, and divers other Exercises. 7. The *Sphæristerium* or Tennis Court, reserved for Exercises wherein they used the Balls. 8. Large unpaved Alleys, which comprehended the Space between the Portico's and the Walls, wherewith the Edifice was surrounded. 9. The *Xisti*, which were Portico's for the Wrestlers in Winter or bad Weather. 10. Other *Xisti's* or open Alleys, allotted for Summer and fine Weather; some of which were quite open, and others planted with Trees. 11. The *Baths*, consisting of several different Apartments. 12. The *Stadium*, a large Place of a semicircular Form, covered with Sand, and surrounded with Seats for the Spectators.

There were several Officers for the Administration of the *Gymnasia*. 1. A Director and Superintendant of the whole, called *Gymnasiarcha*. 2. The *Xistarcha*, who presided in the *Xistus* or *Stadium*. 3. The *Gymnasta* or Master of the Exercises, who understood their different Effects, and could accommodate them to the different Complexions of the *Athlete*. 4. The *Pedotriba*, whose Business was mechanically to teach the Exercises, without understanding their Theory or Use.——Under these four Officers were a Number of Subalterns, whose Names distinguish their different Functions.

The Exercises learned under those different Masters, were either for Defence, Health, or Diversion.——Those for Defence were called Military, as the Exercise of the Javelin, Gladiators, Wrestling, Boxing, Running, Leaping, throwing the *Discus*, drawing the Bow, &c. in all which Exercises, there were Prizes proposed for the Conqueror, thereby to animate Youths, to Combats of divers Kinds, that they might be capable, when Occasion required, to repel the Insults of their Neighbours.——Those for Health, were Walking, Vociferation, Shouting, Holding

one's Breath, &c. Though this Kind of Exercise is not Co-eval with the rest; since it is *Plato's* Sentiment, that they were first introduced into the *Gymnasium*, by one *Herodicus*, prior a little to *Hippocrates*, and not before Luxury and Idleness had reduced Men to the absolute Necessity of applying to Physicians, who discovered then, that nothing contributed more to the Preservation and Re-establishment of Health, as Exercises proportioned to the different Complexions, Ages and Sexes; and being convinced by Experience, of their Usefulness, they applied themselves to it.——*Hippocrates* was the first who treated of the Utility of it, in his Book of *Regimen*; but as he, nor the other Physicians, did not adopt all the Exercises of the Gymnastick Art into their Practice, they left the most violent and laborious, to the Masters of the military and athletick Exercises.

The Exercises for Diversion were Dancing; all the Exercises with *Pila* or Balls; mounting the Horse; riding in Chaise, Litter, or other wheeled Vehicle; rocking in Beds or Cradles; and sometimes swinging; swimming, &c.

The Hope of being proclaimed and crowned Conquerors in the publick Games, which they thought was the highest Honour a Mortal could arrive at, had rendred the *Grecian* Youths over diligent in those Kinds of Exercises, and caused such Emulation among them, that what was originally only Amusement, became at length a Matter of such Importance, as to interest famous Cities, and entire Nations in the Practice.——Nay, in Process of Time, all *Greece* went so far as to imagine, that even *Gods* and *Demi-Gods* were not insensible, of what Men were so captivated withal; and in Consequence hereof to introduce the greatest Part of these Exercises in their religious Ceremonies, the Worship of their Gods, and the funeral Honours done the *Manes* of the Dead.

We have no earlier Monument now extant, of the *Grecian Gymnasticks*, (which is the Name they gave to these Exercises) than the Description of them in the 23d Book of the *Iliad* of *Homer*, where he describes the Games celebrated at the Funeral of *Patroclus*, which was at the Time of the *Trojan War*, and whereby we learn that they had Chariot-races, Foot-races, Boxing, Wrestling, Gladiators, throwing the *Discus*, drawing the Bow, hurling the Javelin, &c. Though Mr. *Burette* in his History of *Gymnasticks*, inserted in the *Memoirs of the Royal Academy of Inscriptions*, believes that this Art is co-eval with the World; for which he has no other Proofs, but a reasonable Supposition.

We have not the least Trace remaining of *Grecian Gymnasia*, which the *Romans* improved and advanced to the utmost Pitch of Magnificence; but the Declension of the Empire having involved the Arts in its Ruin, the *Gymnasia* were deserted, and those sumptuous Edifices entirely ruined; so that all that's seen of them at present, are only the Places where they were erected.

The BRIDGES, the next Piece of Antiquity which falls under our Consideration, are commonly defined an Edifice, either of Stone or Timber, consisting of one or more Arches, erected over a River, Canal, or the like, for the Conveniency of crossing or passing over from one Side to the other.

Abundance of Bridges were erected by the Antients in several Places, but particularly in *Italy*, and on the *Tyber*; whereof some are this Day entire, and others have some small Remains only left to preserve their Memory.——Those which are, at present, entire on the *Tyber*, are that of the Castle St. *Angelo*, called antiently the *Elia Bridge*, from the Emperor *Elius Adrianus*, who erected in this Place his own Monument.——The *Fabritian Bridge*, erected by *Fabricius*, now called the Four-headed Bridge, or *Ponte quattro capi*, from the four Heads of *Janus*, or four *Termini*, placed on the left Hand of this Bridge, whereby the Island of *Tyber* is joined to the City.——The *Cestian Bridge*, now called St. *Bartholomew's* Bridge, which from the other Side of the Island,

passes to *Transyberim*, or over the *Tyber*.—The Bridge called *Senatorio* from the Senators, and *Palatino*, from the adjacent Hill, made of Rustick Work, and now called *St. Mary's Bridge*.

But the *Bridges*, whereof the antient Remains are only to be seen in the *Tyber*, are the *Sublician Bridge*, called likewise the *Lepidan Bridge*, from *Emilius Lepidus*, who made it of Stone, though it was first made of Wood, and was built near *Ripa*.—The *Triumphal Bridge*, whose Pilasters are still to be seen over against the Church of the *Holy Ghost*.—The *Janiculan Bridge*, so named from its being adjacent to Mount *Janiculus*; which because Pope *Sixtus IV.* repaired it, is now called *Ponte Sisto*.—And the *Milvian Bridge*, now called *Ponte Molle*, in the *Flaminian Way*, not two Miles distant from *Rome*, and retaining only the Foundations of its antient Form. It is reported to have been erected in the Time of *Sylla*, by *Marcus Scaurus* the Censor.

There are likewise the Remains of a *Bridge*, to be seen, erected by *Augustus*, of Rustick Work, upon the *Vera*, a most rapid River near *Narmi*; and another of the same Work upon the *Metaurus*, at *Calgi*, in *Umbria*, with particular Counter Work at each End of it upon the Banks; which makes it exceeding strong, and supports the Road.—But among all the celebrated *Bridges*, that is recorded as a Miracle, which *Caligula* built from *Puteoli* to *Baia*, in the Midst of the Sea, almost three Miles in Length; and on which 'tis said, he expended the whole Revenue of the Empire.

There was a *Bridge* built over the *Danube* in *Transylvania*, which was extraordinary great, and deserving Admiration, on which were inscribed these Words. PROVIDENTIA AUGUSTI VERE PONTIFICIS, VIRTUS ROMANA QUIS NON DOMET? SUBJUGOR ECCE RAPIDUS DANUBIUS, *i. e.* Can any Thing be above the *Roman* Strength, assisted with *Augustus*, truly Pontiffs, special Care; after it has stop't the Rapidity of the *Danube*?—This *Bridge* was afterwards broke down and demolished by *Adrian*, to prevent the *Barbarians* from coming over to plunder the *Roman* Provinces; and its Pilasters are still to be seen in the Middle of the River.

But none of the antient *Bridges* appear more beautiful, and more worthy of Observation, than that erected by *Augustus Caesar*, at *Ariminum*, a City of the *Flaminian* Tribe. It is divided into five Arches, the three middlemost whereof are equal, consisting of 25 Feet in Breadth; and the two next the Banks are less, consisting only of twenty Feet. All these Arches consist of a Semicircle, and the Depth of their *Archivolte* is a tenth Part of the Light, or Void of the greater, and an eighth Part of the Light of the lesser ones. The Pilasters as to their Thickness, are a little more than the Half of the Light of the greater Arches. The Angle of the Spurs which cut the Water, is a right Angle, (this the Antients followed in building all their *Bridges*, as being stronger than the acute Angle; and for that Reason, the acute Angle is less exposed to be thrown down and destroyed by Trees, or any other Matter, which rolls down with the Stream) on the Sides of the *Bridge*, there are some Niches, wherein there must formerly have been some Statues directly over the Pilasters. Over these Niches there is a Cornice, the Length of the whole *Bridge*, which, although it is plain, adds nevertheless a most agreeable Decoration to the Work.

Over the *Bacchiglione*, and the *Rerone*, two Rivers which run through *Vicenza*, (the *Bezone* losing its Name at its Entrance into the *Bacchiglione*, without the City) are two ancient *Bridges* built. The Pilasters and one Arch of that built over *Bacchiglione*, are still entire, and to be seen near the Church of *St. Mary of the Angels*; the rest is all modern Work.

The other over the *Rerone*, and which is called by the common People, *il Ponte belle Beccarie*, or the *Butcher's Bridge*, because it is adjacent to the greatest Shambles of the City, is still entire, and varies but little from that on the *Bacchiglione*, being divided

into three Arches, and the middlemost larger than either of the other two.—Both the one and the other of these *Bridges* are composed of *Costozza Stone*, which is a soft Stone, and is sawed like Wood.

The Antients, especially the *Romans*, were not so extravagant in building Places for their Interment, as they were, in all their other Edifices; tho' besides the usual *Sepulchres* for the Interment of the whole Body; or of the Ashes of the Body burnt; they had a particular Kind, called *Cenotaphia*, which were empty *Sepulchres*, made in Honour of some Person, who perhaps had no Burial at all; from a superstitious Opinion, that the Souls of those who wanted Burial, wandered a hundred Years, ere they were admitted to pass into the *Elysian Fields*.

Among the *Romans*, none but the Emperors, Vestals, and Persons signalized by great Actions, were allowed to have *Sepulchres* in the Cities; the rest were all in the Country, near the high Roads; whence those common Words, *Siste, & abi, viator*, which are still retained in the Inscriptions of our Monuments in Churches, &c. tho' the Occasion be no more.

Strabo informs us, *Georg. l. 14.* that at *Anchiale*, was antiently seen the Tomb of *Sardanapalus*, with this Inscription in Verse; *Sardanapalus built Anchiale and Tarsus in one Day; go Passenger, eat, drink, and be merry; the rest is nothing.*

The only remaining Pieces of Antiquity we have of that Kind, are the CATACOMBS, which are a vast Assemblage of subterraneous *Sepulchres* about *Rome*, chiefly at about three Miles from that City in the *Via Appia*, supposed by Mr. *Monro*, in the *Philosophical Transactions*, to have been originally the common *Sepulchres* of the first *Romans*; and dug in Consequence of these two Opinions, that Shades hate the Light; and that they love to hover about the Places where the Bodies are laid. But most of the *Roman* Catholics suppose them to be the *Sepulchres* of the Martyrs, and visit them accordingly out of Devotion, and Relicks thence taken, are dispersed throughout the Catholick Countries after they have been baptized by the Pope, *i. e.* That those Relicks being brought to him, he calls them by the Name of what Saint he pleases.

Each *Catacomb* is three Foot broad, and eight or ten high; running in Form of an Alley or Gallery, and communicating with others; in many Places they extend within a League of *Rome*.—There is no Masonry or Vaulting therein, but each supports its self: The two Sides, which we may look on as the *Parietes*, or Walls, were the Places where the Dead were deposited; which were laid lengthwise, three or four Rows over one another, in the same *Catacomb*, parallel to the Alley.—They were commonly closed with large thick Tyles, and sometimes Pieces of Marble, cemented in a Manner inimitable by the Moderns.—Sometimes, though very rarely, the Name of the Deceased is found on the Tyle: Frequently a Palm is seen, painted or engraven, or the Cypher Xp. which is commonly read, *pro Christo, i. e.* dead for Christ, or for the Christian Religion.

Some Protestant Authors are of Opinion, that the *Catacombs* are heathen *Sepulchres*, and the same with the *Puticuli*, mentioned by *Festus Pompeius*; maintaining, that whereas it was the Practice of the antient *Romans* to burn their Dead, the Custom was, to avoid Expence, to throw the Bodies of their Slaves to rot in the Holes of the Ground: And that the *Roman* Christians observing, at length, the great Veneration paid to Relicks, resolved to have a Stock of their own: Entering therefore the *Catacombs*, they added what Cyphers and Inscriptions they pleased, and then shut them up again, to be opened on a favourable Occasion. Those in the Secret, add they, dying or removing, the Contrivance was forgot, till Chance opened them at last; but this Opinion seems to me very ridiculous and improbable. For what could have induced the Christians of those Days, whom every Body will allow to have been truly pious and religious, to have Recourse to that ridiculous Expedient, since it

was thereby deceiving themselves, with a premeditated Design; for if they wanted Relicks at any Rate, as pretended here, had it not been more agreeable to their Sense and Reason, to have taken the Stones or the Earth of the Street of *Rome*, which had been so often dy'd with the Blood of the Martyrs, which could have kept their Piety in Suspense, if such Stones or Earth had been irrigated with such precious Blood, or not, and therefore excuse their Zeal, than go to the *Catacomb* with the Design to deceive themselves and others? Is it possible that they could have been induced by any Motive whatever, to consider, as Relicks of Martyrs, what they were almost sure were Part of the Skeleton of a vile Slave, or of some infamous Profligate, punished for his Crimes? Those are injurious Reflections, which have not so much as the Appearance of Reason or Common Sense, and which are condemned as such, by the most sensible Part of Protestant Writers.

Antiently, the Word *Catacomb* was only understood of the Tombs of *St. Peter* and *St. Paul*; and *M. Chatelain* observes, that among the more knowing of the People of *Rome*, the Word *Catacomb* is never applied to the subterraneous Burying-places heretofore mentioned, but only to a Chapel in *St. Sebastian*, one of the seven statonial Churches; where the antient *Roman* Calendars say, the Body of *St. Peter* was deposited, under the Consulate of *Tuscius* and *Bascus*, in 258.

It is true, that we cannot say that all those monstrous Heaps or Pyramids of Bones, seen in the *Catacombs*, are all Relicks of Christian Martyrs, since a vast Number of Slaves and Criminals, might have been buried in the same Places; but we cannot say neither, that the greatest Part of them are not the Remains of Christians, who, in those Days of cruel Persecution, sealed their Faith with their Blood: And that the zealous Christians who survived them, did not take all the Care they could, to have them distinguished from the despicable Remains of those who had suffered for their Crimes.

The greatest Pieces of *Antiquity* we have of this Kind still in Being, are the famous *Pyramids*, erected for *Sepulchres* of the *Egyptian* Kings and Queens, which Time, the Seasons, and the different Revolutions which have happened in so long a Course of Centuries, have till now left untouched.

This Manner of erecting stately Monuments for the Dead, was invented by *Artemisia*, who first had a most sumptuous one erected to *Mausoleus* her Husband, King of *Caria*; from whence Monuments of the same Kind, have also been called, since, *Mausoleums*.

The Christians have rivaled, if not excelled *Artemisia*, in the Architecture, and magnificent Decorations of their Tombs; in the Structure whereof, they have employed, besides the Hands of the most skillful Artists, the most precious and costly Materials Nature could supply them with, for that Purpose; as Marble, Porphyry, &c. so that very often, Persons who have not began to make their first Appearance in the World, but after they have been out of it, and having done nothing to eternise their Memory; their Descendants, by an extravagant Principle of a ridiculous Vanity, are forced to have Recourse to the insipid Pen of a beggarly Poet, and to the Chisel of a Sculptor, to supply the Want of Merit in a deceased Parent; and a vast Number of worthless Wretches had never been known to have lived, if they had not been to dye. I laugh when I see the despicable Remains of an *Avare*, covered with a sumptuous Pile of Marble, who, while living, could scarcely afford himself enough Cloathing to defend that same *Skeleton* against the Injuries of the Seasons, and could not rest in Peace, if he could know in the Silence of his Tomb, that he is buried under the Ruins of his Idols.

England surpasses all other Nations in Edifices of that Kind; but if our Magnificence on that Occasions, proceeds rather from a Principle of Vanity,

than of Gratitude, is what I will not pretend to determine; I am only sorry to think, that our Posterity will be surpris'd to find so many despicable Ashes mixed with the sacred ones of our Kings, and with those of the *Cavendish's*, *Stanhope's*, *Godolphin's*, *Cragg's*, *Newton's*, &c. &c. and condemn, perhaps, our depraved Taste, for having put that Jilt *Fortune*, in Com-promise, with so much Merit and Virtue.

Almost all the publick Edifices of the Antients, were adorned with Inscriptions, which have always very much tickled the Curiosity of *Antiquaries*.—*Sanchoniathon*, *Gideon's* Contemporary, drew most of the Memoirs, whereof his History is composed, from Inscriptions, which he found in Temples, and on Columns, both among the *Heathens* and the *Hebrews*.

It appears, indeed, that the Antients engraved upon Pillars, the Principles of Sciences, as well as the History of the World.—Those mentioned by *Herodotus*, shew, that this was the first Way of instructing People, and transmitting Histories and Sciences to Posterity.—This is confirmed by *Plato*, in his *Hippias*, wherein he says, that *Pisistratus* engraved on Stone Pillars, Precepts useful for Husbandmen.—*Pliny* assures us, that the first publick Monuments were made of Plates of Lead; and the Treaties of Confederacy, concluded between the *Romans* and the *Jews*, were written upon Plates of Brass; that, says he, the *Jews* might have something to put them in Mind of the Peace and Confederacy concluded with the *Romans*.—The *Greeks*, and the *Romans* were great Admirers of Inscriptions, and extremely fond of being mentioned in them; and hence it is that we find so many, in those Countries of antient Learning, that large Volumes have been composed of them; as the Collection of *Greter*, &c.

The *Egyptian* Inscriptions were all in *Hieroglyphicks*, which were Symbols, or mystick Figures used among them, to cover or conceal the Secrets of their Theology.—*Hermes Trismegistus*, is commonly esteemed the Inventor of those Symbols, which according to *Clemens Alexandrinus*, are a Kind of real Characters, which do not only denote, but in some measure express the Things—Thus a Lion is the Hieroglyphick of Strength and Fortitude; a Bullock of Agriculture; a Horse of Liberty; a *Sphinx* of Subtily, &c.—The religious Rites of the *Egyptians*, are mostly involved in such Figures of Animals, to be seen still on the Pyramids of *Egypt*, and on the Mummies brought from thence.

The *Sepulchres* or *Tombs* have always had a Sort of *Inscription*, different from the rest, called *ΕΠΙΤΑΦΗ*, which is an Inscription engraven or cut on a *Tomb*, to mark out the Time of a Person's Decease, his Name, Family, and usually some Elogy of his Virtues, or good Qualities.

The Style of *Epitaphs*, especially those composed in *Latin*, is singular. *Cicero* has prescribed the Rules of it; *Accedat oportet oratio varia, vehemens, plena Spiritus, omnium sententiarum gravitate, omnium verborum ponderibus est utendum*. The Discourse must be diversified with Incidents, strong and full of Spirit; all the Thoughts must be noble and grave; and all the Expressions weighty.—An *Epitaph* is commonly neither Prose nor Verse; but a *Medium* between both.

At *Sparta*, *Epitaphs* were only allowed to People who died in Battle.—*Bosbornius* has made a Collection of *Epitaphs*, not very ample, but exceedingly well chosen. Father *L'Abbe* has likewise given a Collection of the like Kind in *French*, entitled *Tre-sor des Epitaphes*.—*Camden* and *Weever* have done something in the same Way in our *English Epitaphs*. An *Epitaph* is said to be yet wanting to the Duke of *Marlborough's* Monument, though a Premium of 500*l.* was offered by his Dowager, to him that should compose one worthy of the Hero deceas'd; and I can scarcely imagine that among so many ingenious Persons *England* affords, none has attempted to deserve

deserve the Premium; but I suppose that her Grace has answered them, as *Christ* did the other *Apostles*, when they inquired about the Fate of *John*, *Sed sic eum volo manere donec veniam, quid ad vos?* If I want him to stay as he is 'till I come, what's that to you? But however her Grace will give me Leave, I hope, to insert here the Plan for one of my own Invention.

Mortuus, sub hoc Marmore, frustra quereretur Johannes, Marlborough Dux, S. R. I. Princeps, Serenissime, et Potentissime Annæ, Magn. Brit. Fran. & Hibern. Reginae, a Secretis, invictiss. Britan. Exercituum Dux Generalis, &c. &c. nam dum a Morte, quam sepius in Campis Blenheim, Ramillies, &c. &c. fugaverit, Pallida, & Tremente insequeretur, a Divis ad Calum raptus, illam iterum Decepit, atque Devixit.

It would be in vain to search here under this Marble the Remains of John Duke of Marlborough, Prince of the Holy Roman Empire, Privy-Counsellor to the most Serene and most Potent Princess, Anne, of Great-Britain, France and Ireland, Queen; Generalissimo of the always victorious British Armies, &c. &c. for while Death (which he had so often put to flight in the Fields of Blenheim, Ramillies, &c. &c.) Pale and Trembling with Fear was following him, he once more deceived and conquered her, the Immortals having ravished him from her, and carried him into Heaven.

The HIGH-WAYS, or *Roads*, of the antient *Romans*, are also Pieces of Antiquity worthy our Notice; and though almost spoilt by Time, yet some of them preserve still in some Places the Memory of their former Beauty and Convenience; and among them the *Flaminian* and *Apian* Ways are the most famous.

The *Flaminian Way* was made by the Consul *Flaminius* after his Conquest over the *Ligurians*; (or *Genoese*) it took its Beginning from the Gate *Flamentana*, (now called *Porta del Popolo*.) and passing through *Tuscany* and *Umbria*, led to *Ariminum*; from whence it was afterwards continued by *Marcus Lepidus*, his Collegue, to *Bononia* (now *Bologna*.) and winding round the Marshes, near the Foot of the *Alps*, ended at *Aquileia*.

The *Appian Way* owed its Name to *Appius Claudius*, who made it with great Labour, and Expence; whence, on Account of its great Magnificence and Art, it was called the *Queen of Roads*.—This Way began from the *Coliseo* (or *Pompey's Amphitheatre*.) and leading through the *Porta-Capena* (a Gate of *Rome* so called) it extended as far as *Brundisium*.—It was carried no farther than *Capua* by *Appius*; and who was the Author of it beyond, is uncertain, tho' by some it is imagined to be *Cæsar*, because *Plutarch* says, that the Care of this Way was committed to *Cæsar*, and he laid out a large Sum of Money upon it.--- It was last of all repaired by the Emperor *Trajan*, who, by draining of Marshes, levelling of Mountains, filling up of Vallies, and making Bridges where it was requisite, made it both expeditious and agreeable to Passengers.

The *Aurelian Way* is also very famous; so called from *Aurelius*, a Citizen of *Rome*, who made it.--- It took its Beginning from the *Aurelian Gate*, now called the Gate of *St. Pancrace*, and extending itself along the Maritime Places of *Tuscany*, ended at *Pisa*.

The *Numentan*, the *Prenestin*, and the *Labican* Ways, were all equally celebrated.--- The first began from the Gate *Viminalis*, now called the Gate of *St. Agnes*, and extended to the City of *Numentum*.--- The second, at the Gate *Esquilia*, now called that of *St. Laurence*.--- The third, from the Gate *Nevia* (which is now the *Porta Maggiore*, the great Gate,) and both led to the City of *Prebest*, now called *Pellegrino*, and to the celebrated City of *Labicana*.

There were several other Ways, such as the *Via Salaria*, the *Collatina*, the *Latina*, and others, which Authors have mentioned, and made famous; every one

of which took its Name, either from the Man who made it, or from the Gate where it began, or from the Place where it ended; but the *Portuensian Way*, which reached from *Rome* to *Ostia*, surpassed them all, no Doubt, for Beauty and Conveniency; because as *Alberti* affirms it, it was divided into two Ways; between each of which there was a Course of Stones, a Foot higher than the Rest of the Way, and which served for a Division; so that People went one Way, and returned the other, whereby they avoided all Hindrances, or Jostling of each other; and it was indeed a very commodious Invention, considering the vast Concourse of People that flocked then to *Rome* from all Parts of the World.

The Antients made two Kinds of those Roads, which they called *Military Roads*; that is, one was paved with Stones, and the other covered all over with Gravel and Sand.—The Ways of the former Kind were divided into three Spaces, as far as by some Remains of them we are able to conjecture.—On the Middlemost, which was higher than the other two, and which rose a little in the Middle, that no Water might rest upon it, but run off immediately, went the People who travelled on Foot.—It was paved with irregular Stones; that is such as had unequal Sides and Angles.—The other two Spaces on each Side of this were made a little lower, and covered with Sand and fine Gravel, being appropriated for the Passage of Horses and other Cattle.—

Each of these Spaces were but half as large as that in the Middle, from which they were divided by a Range of Stones, pitched Edge-ways; and there were other Stones, somewhat higher, at certain Distances, on which they got up when they mounted on Horseback, the Antients not having had the Use of Stirrups.--- Besides the Stones for this Purpose there were others, a considerable deal higher, set at an equal Distance, on which were engraven the Miles of the whole Journey: These were set up, and the Ways measured by *Cneius Gracchus*.

The *Military Ways* after the second Manner; that is, those made of Sand and Gravel, were raised by the Antients a little in the Middle; for which Reason no Water being able to rest upon them, and consisting of Matter, very apt to become dry in a short Time, they were always even and smooth, without either Dust or Dirt.--- Of this Sort there is one to be seen in *Friuli*, which leads into *Hungary*, which by the Inhabitants is called the *Posthumous Way*. There is another of them in the Country of *Padua*, which beginning from the said City, at the Place called *Argere*, passes through the Midst of *Cicogna*, the *Villa* of the two Brothers, the Count *Edward*, and *Theodore de Thieni*, and lead to those *Alps* which divide *Italy* from *Germany*.

The Antients had also magnificent *Villas*, or Country-houses, of which there is none extant, at present, though they pretend to shew some Ruins of that magnificent one of *Cicero* at *Tusculano*.—The antient *Romans* took particular Care to have the principal Front of their Country Buildings turned to the South, which Front had a Gallery, from which there was a Passage into the Kitchen, which received its Light above the Places adjacent; the Chimney being always in the Middle.—The Stalls for the Oxen were on the Left-hand, the Manger whereof was turned to the East.—The Bagnios were likewise on the same Side, and at an equal Distance from the Kitchen, and from the Gallery on Account of the Room they required.—The Oil-presses, and other Places for the Oil, answered the Places of the Bagnios, and were turned to the East, South, and West, on the Right-hand.—The Cellars were backwards, far from all Noise, and open to the North, that they might not be exposed to the Sun.—The Granaries were above, and received the same Light the same Way as the Cellars did.—On the right and left Sides of the Court were Stalls for the Oxen, for the Horses, Conveniencies for the Sheep, and other Animals.—Hay-
lofts

lofts and Barns to put the Straw in, and Bake-houses were as far from the Fire as conveniently could be.—The Master's Apartments were backwards, with the principal Front opposite to the Farmer's House; so that the Halls were always in the back Part of these Country Buildings.

I had almost forgot to mention *Aqueducts*, among Pieces of *Antiquities*, which is a Construction of Stone or Timber, built on an uneven Ground, to preserve the Level of Water, and convey it by a Canal from one Place to another; and in which the *Romans* were very magnificent.—They had some *Aqueducts* that extended an hundred Miles.—*Frontinus*, a Man of consular Dignity, and who had the Direction of the *Aqueducts* under the Emperor *Nerva*, tells us of nine that emptied themselves through 13594 Pipes of an Inch Diameter.—*Vigenere* has observed, that in the Space of four and twenty Hours, *Rome* received from these *Aqueducts*, no less than 500,000 Hogsheads of Water.—There is still an *Aqueduct* of a *Roman* Fabrick, which brings the Water from *Arcueille* to *Paris*.—The *Aqueduct* built by *Lewis XIV.* King of *France*, near *Maintenon*, for carrying the River *Bure* to *Versailles*, is perhaps the greatest in the World.—It is 7000 Fathoms long, and its Elevation 2560 Fathoms; containing 242 Arcades.

The Pieces of Antiquity we have left to examine, as *Busts*, or *Bustos*, *Medals*, *Medallions*, *Manuscripts*, &c. are more properly called *Antiques*.

BUSTS or *Bustos* denote the Figure or Pourtrait of a Person in *Relievo*, shewing only the Head, Shoulders, and Stomach; the Arms being lopped off, ordinarily placed on a Pedestal or Console.

The *Bust* is the same with what the *Latins* called *Herma*, from *Hermes*, *Mercury*; the Image of that God being frequently represented in this Manner among the *Athenians*.

The *Antique Bustos*, were commonly made with the Head of Marble, and the Shoulders and Stomach of Porphyry, or Bronze.—Of them there are none to be seen, except in *France* among the King's Collection of *Antiquities*; at *Rome* and *Florence*, among those of the Pope, and of the Grand Duke; though some of the most curious of our *Antiquaries*, pretend to be possessed of those rare Pieces of *Antiquities*, as well as of,

MEDALS, which are small Figures or Pieces of Metal, in the Form of a Coin, destined to preserve to Posterity the Pourtrait of some great Men, or the Memory of some glorious Action.

Medals have two Parts or Sides, the one called the Face or Head, and the other the Reverse of the *Medal*. Each Side has three Parts, *viz.* the *Area*, or Field; the Rim or Border; and the *Exergum* or *Exergue*, which is a Word, Motto, or the like beneath the Ground whereon the Figures are represented, though oftner placed in the Reverse of the *Medal*.—What we find in the *Exergum* is sometimes no more than some initial Letters, whose Meaning we are unacquainted withal; though sometimes too they contain *Epochas*, or Word, that may be accounted an Inscription.—The *Type* or *Device* of the *Medal* is the Figure represented; and the *Legend* is the Writing, especially that around the *Medal*; tho' in the *Greek Medals* the Inscription is frequently in the *Area*.—The *Legend* serves to explain the *Figures* or *Devices*.

Legends on *Medals*, are either in *Latin* or *Greek*; and their ordinary Subjects, the Virtues of Princes, the Honours they have received, Consecrations, signal Events, publick Monuments, Deities, publick Vows, Privileges, &c. The *Greek* Characters, consisting of Majuscule, or capital Letters, appear uniform on all *Medals*; no Change or Alteration being found in confronting the several Characters; though it is certain there was in the ordinary Use and Pronunciation.—All we observe on *Medals*, is sometimes a Mixture of *Greek* and *Latin* Characters.—

The Character was preserved in all its Beauty till the Time of *Gallienus*.

From the Time of *Constantine*, and for the Space of 500 Years, the *Latin* Tongue was alone used in the *Legend* of *Medals*, even in those struck at *Constantinople*.—*Michael* begun the first, whose *Legend* was in *Greek*; and from his Time the Language, as well as the Characters, began to alter for the worse.

Every *Medal* has two *Legends*, that on the Front, and that on the Reverse. That on the Front for the generality, serves only to distinguish the Person, by his Name, Titles, Offices, &c. and that on the Reverse is intended to express his noble and virtuous Sentiments, his good Deeds, and the Advantages the Publick has reaped by him. This however does not hold universally; for sometimes we find the Titles shared between both Sides, and sometimes also the *Legend*.

In the *Medals* of Cities and Provinces, as the *Type* or *Head* is usually the *Genius* of the Place, or at least some *Deity* adored there; the *Legend* is the Name of the City, Province, or *Deity*, or of both together; and the Reverse some Symbol of the City, Province, &c. frequently without a *Legend*; sometimes with that of one of its Magistrates.

It seems as if the Antients had intended their *Medals* should serve both as Images, and as Emblems; the one for the common People, and the other for Persons of Taste and Parts: The Images to represent the Faces of Princes; and Emblems to represent their Virtues and great Actions; so that the *Legend* is to be consider'd as the Soul of the *Medal*, and the Figure as the Body.

Mr. Patin and *F. Joubert* imagine, that the antient *Medals* were used for Money, and that they had all (even without excepting the *Medallions*) a fixed regular Price in Payments. But those of a contrary Opinion maintain, that we have no real Money of the Antients; and that the *Medals*, we now have, never had any Course as Coins; though we may reasonably keep a Medium between both, and very well suppose, that some of those antient *Medals* we have, were real Money, and some not; but how to distinguish the one from the others, is a very difficult Matter; since we find none number'd by our *Antiquaries* among the *Roman* Coins, and all that *Mr. Patin* alledges in Defence of his Opinion, is but mere Supposition.

Antient *Medals*, properly called *Antiques*, are divided into those of the higher and lower Antiquity; and those again subdivided into *Greek* and *Roman Medals*.

The *Greek Medals* are such as have either the Heads of *Greek* Emperors, or *Greek Legends*.—These are the most antient and the most beautiful; since the *Greeks* struck *Medals* in all the three Metals with such exquisite Art, as the *Romans* could never come up to; the *Greek Medals* having a Design, Accuracy, Energy, and a Delicacy, that expresses even the Muscles and Veins, and it must be owned goes infinitely beyond any thing of the *Romans*.

Medals of the higher Antiquity of both Nations, consist of such as were struck before the End of the third Century; and those of the lower, of such as were struck between the third and ninth Century.

The *Roman Medals* are distinguished by consular and imperial.

The *Consular Medals* are certainly the most antient *Medals* of the *Romans*, since they were struck before the Emperors had usurped the sovereign Authority, and when the Republick was govern'd by Consuls; and yet those of Copper and Silver do not go beyond the 484th Year of *Rome*; nor those of Gold beyond the Year 546. If any are produced of an older Date, they are spurious.

Of the *Consular Medals* *Father Joubert* reckons about 50 or 60 of Gold; 250 of Copper; and near 1000

1000 of Silver.--- *Urfinus* and *M. Patin* have disposed them genealogically, according to the Order of the *Roman Families*, and computes 1037 *Consular Medals*, which relate to one hundred seventy-eight *Roman Families*.--- The *Medals*, whose Edges are cut, or notched like Teeth, which is a Sign of their Purity and Antiquity, are common among the *Consular*; but we have none later than *Augustus*. There are several of them, however, among those of the Kings of *Syria*.

Among the *Imperial Medals* we distinguish between the upper and the lower Empire.--- The upper Empire commenced under *Julius Caesar*, and ended about the Year of *Christ* 260.--- The lower Empire comprehends near 1200 Years, viz. 'till the taking of *Constantinople*, by *Mahomet I.* Emperor of the *Turks*.--- It is the Custom however to account all the *Imperial Medals*, 'till the Time of the *Palæologi*, among the *Antique*, and yet we have no *Imperial Medals* of any considerable Beauty, later than the Time of *Heraclius*, who died in 641.

After the Time of *Phocas* and *Heraclius*, *Italy* became a Prey to the Barbarians; so that the Monuments we have remaining of those two Emperors finish the Set or Series of *Imperial Medals*.--- To these are added the *Medals* of the lower Empire and the *Greek Emperors*; whereof a Series may be made as low as our Time, taking in the Modern ones.--- *Mr. Patin* has made an ample Collection of the *Imperial Medals* 'till the Time of *Heraclius*.

The *Gothic Medals* make Part of the *Imperial* ones: They are so called, as having been struck in the Times of the *Goths*, and in the Declension of the Empire; and favouring of the Ignorance and Barbarity of the Age.

Medals have been struck in three several Kinds of Metal, which make three several Sets or Series in the Cabinet of the Curious, we mean as to the Arrangement of the several *Medals*.--- The Gold Series, for Example, of *Imperial*, amounts to about 1000, or 1200; that of Silver may amount to 3000; and that of Copper, in all of three Sizes, great, middle, and small, to 6 or 7000.--- Of these the Series of middle Copper is the most compleat and easily formed, as it may be brought down to the Fall of the Empire in the West, and the Time of the *Palæologi* in the East.

The Series of *Medals* are usually form'd from the Side called the Head.--- In the first Class is disposed the Series of Kings.--- In the second, that of the *Greek* and *Latin Cities*.--- In the third, the *Roman Consular Families*.--- In the fourth, the *Imperial*.--- In the fifth, the *Deities*; to which may be added a sixth Series, consisting of *Medals* of illustrious Persons.

It is not either the Metal or the Size which makes a *Medal* valuable; but the Scarcity of the Head, or of the Reverse, or the *Legend*.--- Some *Medals* are common in Gold which, yet, are very rare in Copper; and others very rare in Silver, which in Copper and Gold are very common.--- The Reverse is sometimes common, where the Head is singular; and some Heads are common whose Reverse is very scarce.

There are also *Medals* very scarce in some Sets, and yet very common in others.--- For Instance, there is no *Antonia* in the Sets of large Copper, and the middle Copper is forced to supply its Place.--- The *Otho's* are very rare in all the Copper Sets, and yet common in the Silver ones.--- *Otho's* of the large Copper are held at an immense Price; I had one, which I could have sold for five hundred Pounds to the late Duke of *Devonshire*, if his Grace could have been convinced that it was genuine; but as there were but five of them struck, and the Dye broke at the fifth; and *Otho* survived that Accident but a few Days, the Duke was pleased to tell me, that he suspected mine to be a spurious one, because he knew of four already deposited in the Cabinets of some Princes of *Europe*; particularly of the King of *France*,

the Pope, the Grand Duke, &c. and that he could not believe mine to be the fifth, for no other Reason, than because those *Otho's* were so scarce; though those on the Middle Copper are sold at forty or fifty Pistoles; and the *Gordian Affrick*, near as high.--- Singular *Medals* are invaluable.

We commonly understand by singular *Medals*, such as are not found in the Cabinets of the Curious, and are only met with by Chance, as my *Otho*, heretofore mentioned; but in a stricter Sense are such whereof there is not above one of a Kind extant.--- When a *Medal* exceeds the Value of ten or twelve Pistoles, it is worth what the Owner pleases.--- The *Pescennius Niger* and *Pertinax* are very rare in all Metals.--- The *Didius Julianus* is hardly found any where, but in large Copper.--- *Carteron* a Dutchman, and some others, have made Mills on purpose to strike *Medals* that never were, as those of *Cicero*, *Virgil*, *Priam*, &c.

There are no true *Hebrew Medals*; those we see of the Heads of *Moses* and *Jesus Christ*, are spurious and modern.--- We have a few *Shekels* of Copper and Silver, with *Hebrew* or *Samaritan Legends*; but none of Gold; tho' there is Mention made of one in the King of *Denmark's* Cabinet.--- Father *Souciet* has a Dissertation on the *Hebrew Medals*, commonly called *Samaritan Medals*, where he distinguishes accurately between the genuine and spurious, and shews that they are true *Hebrew* Coins struck by the *Jews*, but on the Model of the Antients, and that they were current before the *Babylonish* Captivity.

These *Samaritan Medals* have been infinitely canvassed by the Criticks, both *Jew* and *Christian*; particularly Rabbi *Alascher*, Rabbi *Bartenora*, Rabbi *Azarias*, Rabbi *Moses*; Father *Kircher*, *Vellalpandus*, *Waserus*, *Couzingius*, *Hottinger*, Father *Morin*, *Walton*, *Hardouin*, *Spanheim*.--- It is from the Characters, not from being struck by the *Samaritans*, that they are called *Samaritan Medals*, and none are genuine *Samaritan*, of which Father *Souciet* distinguish four Kinds.

The first bears expressly the Name of *Simon*, and the Subject for which they were struck, viz. the Deliverance of *Jerusalem*.--- The second Kind have not the Name of *Simon*, but only the Deliverance of *Sion* or *Jerusalem*.--- The third Kind have neither *Simon*, nor the Deliverance of *Sion*; but only the *Epocha's*, first Year, second Year, &c.--- The fourth Class have neither any Inscriptions, nor any thing whence one may judge of the Time when they were struck.

The three first Kinds were certainly struck after the Return from the *Babylonish* Captivity, and in the Time of *Simon Maccabeus*, after *Jerusalem* had been freed from the Yoke of the *Greeks*. But tho' struck after the Captivity, Father *Souciet* observes, their Character, shews itself to be that of the antient *Hebrew*, which was used before the Captivity, and the Use whereof was lost by the People, during their Sojourn in *Babylon* and *Chaldea*; but restored after their Return on the same footing as before. He adds, that the Legends are pure *Hebrew*, such as was spoke before the Captivity; that the Character therefore is the true antient *Hebrew* Character; that it was the Custom to write each Language in its proper Character; that if they had departed from this Rule, they had doubtless used the new Character they had brought with them from *Babylon*; that there could be no other Reason, but that on settling all Things on the same Foundation they were on before the Destruction of *Jerusalem*, that could have induced them to use this Character of their Coins. And lastly, that these *Medals* were not struck by the *Samaritans*, but by the *Jews* and in *Jerusalem*.

Father *Souciet* is very full on all these Points, and to the Proofs drawn from *Medals*, adds two others foreign thereto; the first drawn from the Resemblance of the *Greek* Letters, introduced by *Cadmus* the *Phenician*, with the *Hebrew* Character; which was the same with that of the *Phenicians*, as the Language of those People was the same with that of the

Hebrews.

Hebrews.—The second drawn from several various Readings in the Scriptures, which cannot be well accounted for otherwise, than by supposing that the Books wrote before the Captivity, were in the same Character with those *Medals*, and which shew, that it is the Conformity which certain Letters have in that Character, that has deceived the Copist.

From the whole, he concludes, that this Character of the *Medal* is the true antient *Hebrew* Character; and that to judge of the various Readings of the *Hebrew* Text, and the Differences of the antient *Greek* and *Latin* Translations, either from themselves, or from the *Hebrew* Text, Recourse must be had to this Character.

The *Medals* which are defaced or not entire, are called *mutilated Medals*.—And those wherein we find the Letters *Rest*, which shew that they have been restored by the Emperors, *Redintegrated Medals*.

Spurious Medals are either dipt or plated.—The dipt ones are struck of pure Copper, and afterwards silver'd (a Contrivance the Curious have frequent Recourse to, in order to compleat their Sets).—The plated or cover'd *Medals*, are those which have only a thin Silver Leaf over the Copper, but which are struck so artfully, that the Cheat does not appear without cutting them: These are the least suspected.

There are also modern *Medals*, which are such as have been struck in *Europe*, since the Usurpation of the *Goths* has been extinct; and Sculpture and Engraving have begun to flourish.—The first was of *John Huss*, in 1415; if any pretend to be more antient they are spurious.—In *France* there were none struck with the King's Effigy before the Reign of *Charles VII*.

These *Medals* have also their Series; that of the Popes commences only, according to Protestant *Antiquaries*, from *Martin V*. in 1430; from which Time we have, as they pretend, a Series of Papal *Medals*, tolerably compleat, to the Number of 5 or 600. One might likewise have a Series of Emperor's from *Charlemagne*, provided one took in the current Coins; but in Practice they commonly commence from *Frederick II*. in 1463. The Series of the Kings of *France* is the most numerous and most considerable of all the modern Kings.

The Study of modern *Medals* is so much the more useful, as they afford more Light than the antient; and mark the Time and Consequences of Events more precisely; whereas the Legends or Inscriptions of antient *Medals* are very short and simple, and generally without any Date. Add to this, that the antient *Medals* are extremely liable to be counterfeited, by reason of the excessive Price they bear; but in the modern there is not near the Danger of being imposed upon.

Mr. *Vaillant* has collected all the *Medals* struck by the *Roman* Colonies; Father *Hardouin* those of the *Greek* and *Latin* Cities; Father *Noris* those of *Syria*. Mr. *Morel* has undertaken an universal History of *Medals*, and promised Cuts of 25000. He ranges them under four Classes; the first contains the *Medals* of Kings, Cities, and People, which have neither the Name or Image of the *Roman* Emperors: The second contains the Consular *Medals*: The third the Imperial *Medals*; and the fourth the *Hebrew*, *Punick*, *Parthian*, *French*, *Spanish*, *Gothick* and *Arabick*. He begins with the Imperial and brings them down as low as *Heractius*: He places the *Latin* in order before the *Greek*. *Ad. Occo*, a German Physician, and Count *Mezzabarba*, have endeavour'd to range the *Medals* in a chronological Order; but that is impracticable, for in many of the Imperial *Medals* there is no Mark, either of the Consulate, or of the Year of the Reign; and since *Gallienus*, there are few of the Imperial *Medals* that bear the least Trace of Chronology.

The most noted *Medalists*, or Authors on *Medals*, are *Antonius*, *Augustinus*, *Wolf*, *Lazius*, *Pill*, *Ursinus* a learn'd Antiquary, *Aeneasius*, *Hubert Goltrius* a famous Engraver, *Oijelius*, *Sequin*, *Occo*, *Triflan*,

Sermond, *Vaillant*, *Patin*, *Noris*, *Spanheim*, *Hardouin*, *Morel*, *Joubert*, *Mezzabarba*, *Beger*, &c. We have had also, lately, in *England*, Persons of the first Rank who were very good *Medalists*; as the late Duke of *Devonshire*, Sir *Andrew Fountaine*, Dr. *Sloan*, &c. as also Mr. *Cox* and Mr. *Goffet*.

As for *Medallions* they are nothing else but *Medals* of an extraordinary Size, which Princes use to present as a Token of Honour or Esteem, for which Reason the *Romans* called them *Missilia*.

Medallions are distinguish'd from *Medals* by the Volume, that is, by the Thickness and Compass; as well as by the Largeness and *Relievo* of the Head.—They were never current Coins, as *Medals* probably were; they were struck purely to serve as publick Monuments, or to make Presents of.—There cannot be any Set made of them, even though the Metals and Sizes should be join'd promiscuously; the best Cabinets do not contain above four or five hundred; though Mr. *Morel* promises us Figures of above a thousand.

Authors vary about the Time when they first began to be struck; some *Antiquaries* will have it under the Empire of *Theodosius*: But this must be a Mistake; for there were some struck even in the Time of the upper Empire; witness a *Nero*, a *Trajan*, and an *Alexander Severus*, still extant.—*Medallions* of Gold are very rare, as also those of a large Copper.

Medals and *Medallions* are almost coin'd in the same manner with the Money; with only this Difference, that Money having but a small *Relievo*, receives its Impression at a single Stroke of the Engine; whereof for *Medals* or *Medallions*, the Height of their *Relievo* makes it necessary that the Stroke be repeated several Times; to this end the Piece is taken out from between the Dyes, heated, and return'd again; which Process in *Medallions*, and large *Medals*, is sometimes repeated fifteen or twenty Times, ere the full Impression be given; Care being taken every Time the Planchet is remov'd to take off the superfluous Metal, stretch'd beyond the Circumference with a File.—Add to this, that *Medallions* and *Medals* of high *Relievo*, by reason of the Difficulty of stamping them in the Balancier, or Press, are usually first cast or moulded in Sand, like other Work of that Kind, and are only put in the Press to perfect them; by reason the Sand does not leave them clean, smooth, and accurate enough.—*Medals* therefore receive their Form and Impression by Degrees; Money at once.

The Rule whereby they judge the *Medal* to be sufficiently stamp'd is, when feeling it with the Hand, it is found firm, and not to be shaken, as filling the Dye equally every where.

Antient MANUSCRIPTS, are also Pieces of *Antiquity* very much esteem'd by *Antiquaries*, and other curious, the great Number of rare and uncommon ones rendering always a Library valuable.

There are antient *Manuscripts*, which like *Medals* of the first Class, have no Price, such as all Originals of any Consequence, either History, Sacred or Profane, Divinity, especially the Books of the New Testament; those of the Old given for such, being nothing else but simple Copies, though even some of those Copies are very valuable; the antient Fathers of the Church as St. *Albanus*, *Origen*, *Justin the Martyr*, St. *Basil*, St. *Jerome*, St. *Augustin*, St. *Cyprian*, St. *Ambrose*, &c. The History of both the *Greek* and *Roman* Empire. That of the different Monarchies which have risen from the Ruins of those two Empires, &c. &c. but among those Originals and scarce Copies, there are so many spurious ones, tho' so well counterfeited, that the best Antiquary is often deceived in them. There are even some *Manuscripts* written, since the Invention of Printing, which are imposed upon us, as having preceded that ingenious and useful Art.

It is not very easy to distinguish an antient *Manuscript* from a counterfeited one, especially those the

oriental Language, whose Originals being all lost, by the different Revolutions happening in those Countries where they were first written; and those Languages, as they are spoken at present, very different from what they were at first, we cannot compare them with the Copies, and therefore are obliged to trust to those Copies, often but too imperfect, as if they were Originals.

I know very well that all *Originals* in those Languages have not undergone the same Fate; especially as to the Books of the new Testament, and the Works of some of the antient Fathers of the *Grecian* Church, of which there are still some few Originals extant, which have been saved from the Ruin of the Eastern Empire; and even those are but in a very small Number, and to be seen but in the most celebrated Libraries, as those of the *Vatican*, of the King of *France*, of the *Grand Duke*, the *Bodleian* and *Cottonian* Libraries, &c.

The best *Manuscript* Bibles are those copied by the *Jews* of *Spain*. Those copied by the *Jews* of *Germany* are less exact but more common.—The two Kinds are easily distinguished from each other; the former being in beautiful Characters like the *Hebrew* Bibles of *Bomberg*, *Stephens*, and *Plantin*; the other in Characters like those of *Munster* and *Gryphius*.—*F. Simon* observes, that the oldest *Manuscript Hebrew* Bibles are not above 6 or 700 Years old; nor does *Rabbi Menaham*, who quotes a vast Number of them, pretend any of them exceed 600 Years.

There are several different *Manuscripts* of the Bible in all the oriental Languages, viz. *Hebrew*, *Samaritan*, *Chaldee*, *Syriac*, *Arabic*, *Æthiopic*, *Coptic*, (of which there's one in the King of *France's* Library) and *Greek*.

The great Difference found between the different *Manuscript* Copies of the antient Fathers, and the Faults and Imperfections they are crowded with, proceed sometimes from the Ignorance, sometimes from the Unfaithfulness, and sometimes from the Partiality of the Copists; which the better to understand, we must know, that most of those Copies were written by Monks, who often for want of very well understanding the true Sense of those Fathers, whose Works they were employed to copy or transcribe, or perhaps divided in their Sentiments, as to religious Matters, each of them gave to the Original what Sense they thought most favourable to the Sect they were most inclined to; and as the oriental Church has been always infected with Heresy and Schism, and its Peace disturbed by an infinite Number of different Sects, it is not at all surprising, if a great many of the antient *Manuscripts* of the Fathers, we have among us, have often made us suspect the Authors of Heterodoxy, and have even been often the Occasion of our religious Divisions.

I do not believe it necessary to take any great Notice here of *Mummies*, which are also considered as Pieces of Antiquities, since we have but very few, perhaps none at all, genuine ones; and as ever since our Antiquaries have dealt that Way, we have no less than twenty *Ptolomies*, besides as many *Cleopatra's* brought over to us, besides those left under the *Egyptian* Pyramids, and reserved, as I suppose, to divert our Posterity, as these have diverted us, though at the same Time they have very much puzzled our Antiquaries in the Explanation of the *Hieroglyphicks*, those *Mummies* are powdered with.—I remember very well that the last *Cleopatra* I saw (for I have seen already five or six for my Share) one of those learned Gentlemen was poring over the *Hieroglyphicks*, the Royal Mummy was adorned with,

which were not very few, by which his pretending he understood very well that it was really *Cleopatra*, he convinced me that he knew nothing of the Matter, and that he was as ignorant in *Hieroglyphicks*, as he was unacquainted with *Cleopatra's* Face, while living.

There are still to be seen in some Cabinets some *Cornelian Antiquities*; either in *Relievo*, or indented, which are the finest Pieces of antique Engravings we have left, but there are very few genuine, and a vast Number of spurious ones to be met with every where, especially in *Italy*, where they drive a Sort of Trade of them, as well as of spurious Medals.

In the late King's Reign an *Italian* Gentleman, with whom I had been acquainted at *Bologna*, had brought some over with him in *Regalo*, as he was pleased to term it; for some *English* Gentlemen he had known while on their Travels in *Italy*; he landed at *Dover*, where being addressed to a noted Banker, who was to pay him some Money, the Banker asked him if he had brought any Thing along with him liable to pay Duty? My Friend answered he had nothing but his Cloaths, and a few *Antique Cornelians*, which he shewed him, and told him farther, he designed them as Presents for some Friends he had in *London*; the Banker told him that they were contraband Goods, and that he did run the Risk, if they were found upon him, to have them confiscated; but if he pleased, he the Banker, would purchase them, and thereby prevent any Accident of that Kind; my Friend answered, that they were not to be sold, and that he could not imagine that the Officers of the Customs could ever suspect he had such Things, or offer to search him upon the Road, when they had not done it at his Landing. Therefore he and the Banker parted, seemingly very great Friends; but my Friend was no sooner arrived at *Canterbury*, but he was visited at his Inn by the Officers, in all Appearance, on the Intelligence of the over-officious Banker, and had his *Cornelians* taken from him, which he valued at 250*l*.—At his Arrival in *London* he applied to General *Wade*, to whom he was recommended: The General, who is one of the most polite, most complaisant, most obliging, and most generous Gentleman of the Age, promised him to assist him all he could in the Recovery of his *Antiques*, and in Fact applied, for that Purpose, to the King himself. His Majesty, who naturally abhorred Perfidy and Treachery, and was always very ready to do good, told General *Wade* that he would have Restitution made of those Effects; but when that Order was notified to the Custom-house, Part of the *Antiques* were missing, and there was so many Fees to pay for what was left of them, that my Friend thought proper to abandon the Prey; and his Friends were obliged to be contented with his generous and liberal Intention.

This Narration, will be thought, perhaps, foreign to my Subject, though, in my Opinion, it will prove of some Utility to Travellers, by cautioning them against those Sorts of Antiquaries, who are always ready to purchase *Antiques*, as well as other Things, at a very moderate Rate; and I would have them avoid by all means trusting too much to the Probity of *Dover* Bankers, who are *Mislagogi* of a new Stamp, since instead of shewing to Strangers the *Antiquities* of the Place, they on the contrary shew to those of the Place, how to find *Antiquities* among Strangers.

ANTHROPOPHAGY.

ANTHROPOPHAGY, from *ανθρωπος*, Man, and *φάγειν*, *Edere*, to Eat, is the savage and barbarous Custom of eating human Flesh, which some Authors believe to have began soon after the *Deluge*; and attribute it to the Giants, occasioned perhaps, by the Description the antient Poets give us of the Ferocity of their Manners, and of their monstrous Size, which might have made those Authors suppose that they had a very voracious Stomach; and that the *Deluge* having laid the Earth waste and desolate; the Giants, through Scarcity of other Provisions, were obliged to eat human Flesh; though *Nimrod*, who was the first of that Species of Men, is not reproached with it in the Sacred History, and is called by *Moses*, Gen. x. 9. *a mighty Hunter before the Lord*; for it is not to be supposed that he chose his Sport among Men, else, as there were then but very few, he had soon extirpated, a second Time, the human Race from the Face of the Earth.

Anthropophagy has always been rather the Vice of the Age, than of any Nation or Country; and *Homer* by representing the *Cyclops*, the *Leſtrigons*, and *Scylla*, as *Anthropophagi*, or Men-eaters, does it only to condemn the Manner of the Times preceding his own, and not to upbraid any Nation in particular, with that barbarous Custom. Though in most Nations, before the Arts and Sciences had been introduced among them, to curb their natural Ferocity, and soften their Manners, were addicted to that barbarous Custom. Tho' the most sensible Part among them, which we'll suppose the most considerable, Men of an Understanding superior to the rest, and who consulted their Reason, rather than their sensual Appetites, could find within themselves, a certain innate Aversion to a Custom so contrary to Humanity and Compassion, and to that natural Inclination every Individual has of propagating his Species. They could even have been directed in that by the Examples of other Animals, who seldom devour those of their own Species.

Orpheus is said to have been the first who drew Men from that savage Custom, which gave Rise to the Fable of his taming Lions and Tygers.

*Sylvestres homines, fater, interpresque Deorum
Cædibus, & victa fædo deterruit Orpheus:
Dietus ab hoc lenire Tigres, rapidosque Leones.*

HORACE.

Mr. *Petit*, a famous French Surgeon, has disputed the Question, whether or no *Anthropophagy* was contrary to Nature, though the Controversy is not of a very great Consequence to Mankind, nor the Question very difficult to be resolved. Nature, considered in itself, and abstracted from all its differential Qualities, is a careful and tender Mother, which contributes all in her Power towards the Preservation and Propagation of its Productions, and seeks the Destruction of none; never better pleased than while the rational, sensitive, and vegetable World are in a flourishing State, and that just Economy and Subordination established from the Beginning, between every Individual for the Preservation of the whole, subsists always in the same good Order. But if we can reasonably suppose, that we might see Nature in another Prospect, as in some Measure partial in its Operations, and more intent on the Preservation of a certain favourite Kind; we'll soon understand that the favourite Kind must be the human Race, without whose Concurrence, Nature itself would soon be in a languishing State, since its natural potential Fertility, the Temperature of the best Climates, and the Influences of the most auspicious Planets, would remain unactive; or rather their united Efforts prove ineffectual, if not helped, in their different Operations

by Men's Industry: 'Tis that Industry alone, which excites the natural Fertility of Nature's Womb, by procuring an Ingress into it, to the prolific Beams of that radiant Planet, whose Approaches change her deepest Mourning, into the inexpressible Joys of a bridal Day. How could it be then a Question, whether or no the Destruction of so kind a Friend, and so potent an Ally, is against Nature or no? But without having Recourse to those Metaphysical Considerations, let us but consult ourselves, and listen to the Dictates of that same Nature within us, and we'll soon find by our natural Appetite nauseating against such barbarous Custom, that *Anthropophagy* is against Nature; and that those who have followed it must have silenced its Dictates, and proved insensible to its Motions.

Some extraordinary Circumstances, when Famine, Hunger, and the Preservation of a considerable Body of Men, seem to have tolerated that Custom, prove nothing in Defence of *Anthropophagy*, or that it is not unnatural to devour our fellow-Creatures; even the most obdurate, especially those who had not renounced all Sentiments of Humanity, have compassionated the unhappy Fate of those reduced to that cruel Necessity; which has been sometimes the deplorable Fate of People at Sea, who have been forced to decimate themselves, and eat some of their Companions to save the rest; but then, without that cruel Expedient, the whole Crew was in imminent Danger, and there was no other Remedy left for their Preservation, but that; and then with what a Flood of Tears and Number of Sighs, Nature used to season those unsavory Viands! Though were we to silence Nature, steal the cruel Banquet from our Sight, and consult only our sensual Appetites, human Flesh being fed more deliciously than others, is also more palatable and succulent; but I hope that our sensual Appetite is not to be accounted as a Nature in us.

During long Sieges, the Besieged being reduced to the last Extremity for want of Provisions, have thro' Obstinacy, and rather than surrender to an implacable Enemy, have had Recourse to that cruel Expedient. On those Occasions, Mothers themselves have devoured their own Children; as it happened while *Jerusalem* was besieged by *Titus*, which being related to *Titus* himself, at that Time the most human and the most compassionate of Mankind; he was so shock'd at it, that he called to the Gods tutelary of the Roman Empire to witness, that he was guiltless of that Piece of Barbarity; in Fact, the *Jews* were the only ones to be blamed on that Occasion, since they knew they must surrender at last, and could not do it to a more merciful and generous Foe than was *Titus*.

Thus some Christian Countries have also been reduced, on such Occasions, to the same Necessity; but as such Practice is contrary to the Principles of the Christian Religion, which tolerates nothing but what's agreeable to the strictest Rules of Humanity, and that we have no authentick Memoirs to support those Accounts, we'll look upon them as Apocryphal.

'Tis true, that Christianity was accused in its Infancy, by the Pagans, of being guilty of *Anthropophagy*; of celebrating *Thyestea Epula*, and allowing *Ædipodei concubitus*.—They affirmed that in the Mysteries of their Religion, the Christians killed a Child, and feasted on his Flesh; but this proceeded from the imperfect Notion they had of those Mysteries, particularly that of the *Eucharist* and Communion, wherein the Christians confessed they received the Flesh and Blood of their divine Saviour *Jesus Christ*; and as the Pagans were ignorant in what Manner that great and incomprehensible Mystery was effected, they took Occasion from their Ignorance to calumniate

calumniate the *Christians*, as, if they had been really *Anthropophagi*.

Anthropophagy is banished at present from among all civilized Nations, and confined to some Parts of *Africa* and *America*, among barbarous and despicable Nations, who have nothing of *Man* but the single Appearance, and who feast on the Flesh of their Enemies, taken Prisoners in War. 'Tis said that the *Hottentots* at the *Cape of good Hope*, are of that Kind; and I have been informed by a *Roman* Catholick Missionary, that the *Tapicourous*, a savage Nation on the Coast of *Brazil*, were *Anthropophagi*, before he came among them, where he was twenty Years before he could conquer in them that savage and barbarous Appetite; that even some of those he had converted to Christianity, were often guilty of that Practice, and were never better pleased, than when

they could steal from him to their inhuman Banquet. That they were even so much used to it, that when first they abstained from it, it caused a Sort of Revolution in the Humours of their Body, so as to cause a Sort of Sickness among them, which ceased when once their Stomach was accustomed to other Food.

Livy tells us, that *Hannibal* made his Soldiers eat human Flesh, to render them more fierce and daring in Battle.—And *Pliny* mentions *Scythians*, and *Sauromatans*; *Solinus*, *Ethiopians*; and *Juvénal*, *Egyptians*; who accustomed themselves to this horrible Repast, *Plin. Hist. Nat. l. 4. c. 12. l. 6. c. 17. 30. lib. 7. c. 2. Solin. Polyb. c. 33.* which cannot be believed of so great a Man as *Hannibal*; especially on the single Report of *Livy*, who is not a very faithful and impartial Historian, no more than *Pliny*.

A P O T H E C A R I E S.

APOTHECARY, from *Αποθηκη*, *Shop*, is a Person whose Profession is to execute the Physician's Prescriptions, in the Preparation and Composition of Medicines or Remedies, which are to be administered to the Patient.

I say, to execute the Physician's Prescriptions, contrary to the common Practice of a vast Number of *Apothecaries*, who when they are once instated in a Shop, (adorn'd with Boxes, Vials, and Gallipots, most of them empty, and with the least Tincture of *Pharmacy*, often but with a very confused one, and almost always without the least Notion of Physick) have the Impudence to act as *Physicians*; and with a Temerity which the Legislature of all Nations has at all Times, and in all Ages condemn'd as pernicious to the Commonwealth, administer of their own Head, and without proper Advice, pretended Remedies, more capable to destroy the Constitution of a Patient, and accelerate his Death, than to restore him to his pristine State of Health.

It is not always the Merit of the *Apothecary*, but rather that of his Shop, which gives him the Vogue; an experienced and learn'd one, if settled in a Corner, or in an indifferent Manner, is disregarded, if not entirely despised, while an Ass, who has Money enough to purchase, *une boutique bien Achalandée*, or a well accusom'd Shop (as they call it) so as to be ready to pop into it, at the Demise or Retirement from Business of an eminent one, comes presently into a flourishing Practice, and with his *Quid pro Quo's*, or *Ripopees*, kills as many Patients, in a few Months, as his judicious and experienced Predecessor had saved in several Years of regular Practice, tho' it is very rare to hear that he is charged with those Murders; why? because his Shop has been for several Years before, a Shop of very great Business, and very noted, therefore the Merit is in the Shop, not in the Person that keeps it.

The Irregularity of the *Apothecaries* in their Practice has rendered them in several Countries the Scoff of Mankind; in several Provinces of *France*, they are excluded, by their Profession, from all the Places or Posts of Honour in the Towns or Cities where they are settled, none of them can be chosen Mayor, or *Echevin*, who is a Sort of Alderman, and are not rank'd among the Burgesses; they are no where so well respected as they are here, and perhaps there is no Place where they deserve it less. Though I don't speak here of all the *Apothecaries* in general, since I am conscious to myself, that it is a very honourable Profession, and very advantageous to the Commonwealth, when practised according to the Regulations made for that Purpose.

A good *Apothecary* who does not attempt to soar above his Sphere, is as much to be valued and re-

spected as a Physician, and they both act always in concert for the Preservation of their Patient and his Recovery.—On the Skill of the *Apothecary* in the Preparation of the Remedies, depends in part the Success of the Physician, and a vast Number of Patients die, not thro' want of Judgment, Knowledge or Experience in the Physician, but because the ignorant *Apothecary* did not, or would not understand how to execute his Prescriptions.

If I mention here that an *Apothecary* will not sometimes understand the Prescriptions of a Physician, 'tis because there are some of them, who pretending to a greater Knowledge and Experience than the Physician himself, have the Vanity to lay aside his Prescriptions and prescribe themselves.—If the Remedy has the desired Effect, then the *Apothecary* discovers himself, and gains the Reputation due to the Physician; if the Remedy miscarry, the *Apothecary* stands hid behind the Curtain, and the Physician bears the Brunt, and answers for the ill Success. Through such unfair Dealing, the *Apothecary* often finds the Secret to supplant the Physician in a Family which he had served faithfully, and that Family is exposed to all the Dangers which may be occasioned by the Ignorance and Blunders of the *Apothecary*.—That Family is not exposed here alone; for, insatuated with the pretended Skill of its *Apothecary*, it recommends him to another Family; that Family to another, and thus till the *Apothecary*, like *Michael Morin*, or the *Mock Doctor*, is made Physician almost in spite of himself.

There is another Allurement in this which contributes much towards establishing the Reputation of an *Apothecary*, which is the View of saving a Physician's Fees, which in *England* are certainly very exorbitant, and which render the *Apothecary* more necessary than if those Fees were more moderate.—A Patient considers, that if he has a Physician, and an *Apothecary*, he must pay both; that if he has the Physician alone, that won't do, for tho' he writes his Prescriptions, and could very well execute them, he will not, or must not, unless he chuses to be consider'd as a Quack, or exposed to lose his Credit among the *Apothecaries*; when, on the contrary, if they have a good *Apothecary*, they have both a Physician and an *Apothecary*, and are only obliged to pay one; without considering the great Inconveniencies they are exposed to by their false Reasoning. 1. That trusting their Lives into the Hands of a Person, who having no other Education, but what he has acquired in a Shop among Pots and Boxes, and no other Learning but what he has pilfered from some Authors, among whom it was impossible he could make a just Difference between the good and bad, it is equally impossible he should know their different Constitutions, the

the Causes, and the different Symptoms of their Maladies; when and how to apply the Remedy, which must be the Effect of a serious Application, and a long Study, and which we cannot acquire but by the frequent and repeated Lessons of profound and learn'd Masters in that divine Science, on which depend the Safety and Preservation of every individual Subject of the Republick.—I make the same Difference between a Physician and an *Apothecary*, that is between a skilful Painter, and the Person who mixes his Colours; as it would be a Presumption deserving Punishment in that Person to attempt to touch his Master's Work, it is equally the same in an *Apothecary* who presumes to invade a Physician's Province.

What! for Example, cannot we trust to a good and experienced *Apothecary*, who, for several Years, has executed all the Prescriptions of the most famous Physicians of the Age, and has always accompany'd them in the most difficult and dangerous Cases? While he has all those Prescriptions filed in his Shop, and knew for what Distempers they were written? If he won't trust wholly to his Judgment, can't he have Recourse to those Prescriptions, and execute them in the same manner he has so often done already, while he was an Eye-witness of the good Effect they have produced? No; for we know by Experience, that the same Prescription which has had a good Effect once, has often produced a contrary one, though administer'd to the same Person, and for the same Malady.—Our Constitution is exposed to the same Changes and Variations the Age and the Seasons are subject to; such and such Constitutions are not the same this Year they were the Year before; they have been more affected by the Seasons, which also have not been the same; their Diet has been different, and consequently has alter'd the Quality of the Humours, their Consistence, Quantity, &c. and therefore are to be treated in a different Manner (as we'll explain it more at large in the Treatise of Physick) though perhaps for the same Distemper; how can then those old Prescriptions, if ever so good, be of any Utility to the *Apothecary*? And how can he answer to God and Men, for administering them at Random? Are our Lives of so little Consequence as to be trifled with? Are the Members of a Commonwealth to be cut off with Impunity? Unless it be the gangrened ones, and then the Body politick has other Executioners appointed for that Office.

If an *Apothecary* is called to a Patient by a Principle of Parsimony, to save Money, People are also mistaken in that; for if seemingly, an *Apothecary*, because forbidden, takes no Fees, he nevertheless finds the Secret to have them paid in the Procrastination of the Cure, and in the vast Number of Bolus's, Juleps, Pills, Electuaries, Apozems, &c. he loads his Patient with, when perhaps an able Physician, had cured him in half the Time, and with half the Remedies. Therefore if a Patient would take the Pains to make an exact Calculation of what it has cost him, when attended by his *Apothecary* alone, and when by both a Physician and an *Apothecary*, he'll find that the first has been a great deal more chargeable to him than the last.

Not but that I know very well that it is often very expensive to have both, especially when the *Physician* is one of those who are in L'ee with the *Apothecary*, who to retain him for future Services, or to shew his Gratitude for past Favours, prescribes ten Times more Physick than the Patient has really Occasion for; for in Fact very few *Apothecaries* like a Physician who prescribes but a little Physick; else how could they live in such Splendor, as some of them do, if Physicians were to presume to recover their Patients with two or three simple Prescriptions? It would be a Crime of Leze-Faculty, as *Moliere* calls it.—If a conscientious Physician offers to leave a Patient's Chamber, without putting Pen to Paper; the *Apothecary* commonly informs the Patient, by Way of

Friendship, that whenever his Physician does not prescribe, he need not give him any Fee. A Patient who loves his Money is apt enough to take such an Hint; and if the Doctor is not a Man of very dull Apprehension, he takes Care not to commit the same Fault a second Time.—Happy would it be for the miserable Patients here in Town, if the Load of unnecessary Physick which they swallow down, though it does them no Good, did them no Harm, it would be no great Matter if their Pockets alone smarted for their Folly; but alas! this is not the Case; their Lives, or at least their Constitutions often pay for it. A Physician, to keep in with the *Apothecary*, is often obliged to silence his Conscience, and forget the surest Rules of his Art. And sometimes so far (let it be said to the Scandal, not of the Profession, but of the Practice,) as to destroy by a second Remedy the good Effect the first had produced, to keep himself and his *Apothecary* longer in Pay, whereby the Patient is often reduced to such Extremity, that both *Physician* and *Apothecary* found themselves at last out of their Latitude, and the poor Patient is very well off, if after a tedious Rotation of Remedies, and Counter-Remedies, he is so happy as to escape Scot-Free.—So that our Constitutions are, properly speaking, a Stage where those *Charlatans* play their Farces to pick our Pockets.

There is another Artifice used by Physicians, especially young ones, who want Practice, to ingratiate themselves with *Apothecaries*, which is that of entering into Copartnership with them.—A young Physician, just come from the University, and who has some Money, by going to lodge at an *Apothecary's*, or in his Neighbourhood, and by presenting a gold Watch, a Tankard, or some other trifling Matter to the Lady, may depend on being called to the next Patient, capable to give a handsome Fee, or worthy of a copious *Recipe*.—Such Argument is more persuasive than the most authentick *Diploma's* obtained of the best Faculty in *Europe*.

Guy Patin, a French Physician, exclaims loudly against such Mal-Practices among the *Apothecaries* at *Paris*, whom he calls in his *Lettres Choissies, des Cuisiniers Arabesques*, who to be even with him, would have had him prosecuted for Atheism; and went so far as to attempt to surprise the King's Piety against him.—They gained the Clergy on their Side, who censur'd *Patin's* Letters as obscene, prophane, and what not; but however *Patin* proved at last too strong for the murdering Fraternity, for he persuaded the Physicians of *Paris* to employ as few *Apothecaries* as they could, and to prescribe such Remedies (which he knew very well, would have a better Effect than all the *Ripopees* of an *Apothecary's* Shop) by Valets, Chambermaids, and other Servants.—They had also a Book printed, which is still extant, called *Le Medecin Charitable*, which contained a great Number of Prescriptions, for the best and most simple Preparations, with the lowest Price fixed to it.—The Bookseller appointed to sell this Book, sold also those Preparations; all Syrups were sold for two *Sous* an Ounce, and the Rest of the Medicines at the same moderate Rate; and for a still greater Humiliation of the *Apothecaries*, they obtained an Arret of the Council, which subjected all the *Apothecary Shops* of *Paris*, to the Inspection of the Physicians. That Arret was registered in Parliament, and for a very considerable Time put in Execution by the Physicians, with the greatest Exactness and Severity, visiting and rummaging every six Months all the Gally-pots and Boxes in the *Apothecaries-Shops* of *Paris*, destroying, throwing in the Street, &c. all the stale Compositions and other poisonous Medicines, which they thought not fit to be administred to a Patient; but in Process of Time those Arrets, like our Acts of Parliament, grow old, and are very little minded. The Physicians of *Paris* visit still, perhaps once a Year, the *Apothecaries* Shops, but it is only for form Sake; as in the same Manner the Quest-Men visit here our Shops for Weight and Measure; for the *Apothecaries*, who know

know the Day fixed for the Physician's Visit, take Care to have nothing in their Shops but what can bear Inspection, just as some of our Shopkeepers have two Sets of Weights, false ones for the whole Year, and good ones against the Quest comes, which is a scandalous Practice in the Quest-men, not to surprise them unawares, since they should consider how much the poorest Sort of People suffers by such illicit Way of trading.—Let this Advice be given *en Passant*.

As for the *Apothecaries* Shops of *Paris*, we are obliged to confess that they are not at present so much pestered, or rather infected with poisonous Compositions, as they were, perhaps, in *Patin's* Time.—As they have better and more correct *Pharmacopæia's* or *Dispensaries*, such as that of *Charas*, *L'Emery*, &c. than they had then; they are not obliged to old galle-nical Preparations of *Ripopees*, whose Preparations were very expensive, and which were spoiled in a few Months.—Another Advantage which the *Parisian Apothecaries* have, is, that most of them are Persons of liberal Education, and therefore capable, with the Assistance of their Practice, to acquire a greater Knowledge than those deprived of that Advantage, notwithstanding which, they seldom attempt any difficult Cases without the Advice of a Physician, neither could they do it if they would, for the *French* are very much infatuated with the Merit of their Physicians, very few of them, particularly those of any Note, being very willing to die without the Faculty's Leave.

Perhaps it may be objected, that a Physician's Fee, is not so exorbitant in *France* as it is in *England*, which is the Cause that Physicians are oftener called to Patients. 'Tis true, that, those the most in Vogue excepted, all other Physicians content themselves almost always with what the Patient is pleased to give them, and they all visit the Poor *gratis*; a Physician there would soon lose his Reputation, if it was known that he has refused to visit a Patient, because he had no Fee to give him, which is not the Case here in *England*, for I really believe that the Supineness and Self-Interest of our Physicians is the Cause that our *Apothecaries* are so much in Vogue, and resorted to.—For to speak impartially, and without Prejudice, the Difference between our Physicians and our *Apothecaries* is, that our *Apothecaries* have a great deal more Charity and Compassion than the Physician.—A Physician would be ashamed to have his Coach stopped at the Door of a poor Man, while the *Apothecaries* seldom refuse to go there a Foot, and not only give all the Advice they are capable of *gratis* to the poor Patient, but supply him likewise with Remedies from their Shops, which are commonly very good; some of them are even so kind, that when the Case is difficult, they apply to the Physician they are most intimate with for his Advice, who dare not refuse them, though he would the poor Patient; for which our *Apothecaries* are very much to be commended and valued; for if the Patient die, through their Want of Knowledge, it is not their Fault, (since they have done all that could be reasonably expected from them,) but of the Physician, who had the Barbarity to refuse his Advice.—I know that some Physicians pretend to give their Advice *gratis* to the Poor, but it is only to those who are able to wait on them; as for the others who are forced to keep their Bed, and consequently want it most, they must go without.

If the few Abuses, which have been introduced among our *Apothecaries*, were reformed, they would be a Body of Men still more valuable, and more serviceable to the Commonwealth than they are.—Such Reformation would be easily accomplished, if they would take the following Method.

1. To establish an Order among them, That each *Apothecary* should take but a certain Number of Apprentices at once, which should never exceed two for those of the most in vogue.—That those Apprentices should understand *Latin*, at least.—That they should not spend half their Time in going of Errands,

or in the Drudgery of the House; but apply themselves wholly to the Study and Practice of their Art, in which they can never be too perfect.—That when their Time of Apprenticeship is expired, they should undergo a severe *Examen* by the Censors of the College of Physicians, before they could set up for themselves.—And that those who then should be found deficient, should be obliged to serve as Journeyman (for which they should be allowed a competent Maintenance from the *Apothecary* they serve) till they have gained a due Qualification.

2. That all Dispensaries, established under Pretence of selling Medicines cheaper than an *Apothecary* can afford to sell them, should be entirely suppressed; in Consequence whereof the Price of those Medicines should be fixed by the College of Physicians; for it is equally unjust, that the Publick should be imposed upon, as it is that the *Apothecaries* should be deprived of an honest and competent Livelihood, agreeable to their Profession, which is a very honourable one among us.

3. That all the Petty Shops of Quacks, and ignorant Retailers of poisonous *Nostrums*, so prejudicial to the Common-wealth, should be entirely suppressed; and the Delinquents punished with the utmost Severity; whereby we should soon see a very great Reformation in that formidable Army of *Apothecaries*, so loudly and so justly complained of; for it is a Scandal to the Profession to see ignorant Puppies turn *Apothecaries*, because they do not know what else to do.—For my Part, I know a whole Regiment of them, who if they were sent on our foreign Expeditions would do more Execution, by their pretended Skill among our Enemies, than even our brave and invincible *Vernon* himself; for two or three of them introduced into a *Spanish* Garrison, would soon find the Secret of sending three Parts of it over the *Acheron*.

4. To have always their Shops stocked with the best Medicines, to be very careful in the Choice of their Drugs, never buying them for their Cheapness, but because they are good.—Those Drugs consist in *Gums*, *Resins*, *Wood*, *Roots*, *Barks*, *Fruits*, *Simples*, *Balsams*, &c.—The *Gums* are, Gum Amine, Arabic, Gutta, Adraganth, Ammoniac, Opoponax, Asia Foetida, Bdellium, Balm, Benzoin, Camphor, Copal, Elemi, Frankincense, Euphorbium, Galbanum, Lacca, Manna, Myrrh, Olibanum, Sagapenum, Sanguis Draconis, Sarcocolla, Staete, Storax, Tarcamahaca, &c.—The *Resins* are, Turpentine, Mastick, Rosin, Scamony, Jalap, Turbith, &c.—*Balsams*, are those of *Gilead*, of *Peru*, of *Tolu*, of *Copaiba*, of liquid Amber, of *Mecca*, and the Carpathian Balsam.—The *Woods* are, Guaiac, Aloes, Sassafras, Nephreticum, Santal, Sarsaparilla, Aspalathum, Eagle-wood, &c.—The *Roots* are, Rhubarb, Rhapontic, Ipecacuanha, Jalap, Zedoary, Galangal, Cassumenar, Gentian, Tarmeric, Liquorice, Maddar, &c.—The *Barks* are, the Quinquina, or Jesuit's Bark, Macer, Chacarilla, &c.—*Fruits* are, Jujubs, Dates, Tamarins, Mirabolans, &c.—The *Flowers* and *Simples*, they can be provided with from the Botanic Gardens, and Herborist-Shops.

The Proprieties, Virtues, and Choice of these Drugs, will make Part of our *Pharmacopæia*, under the Letter *P*.

They must have, also, some Quantity of Electuaries, Syrups, Conserves, Tablets or Lozenges, Trochea, stilled Waters, &c.

The *Electuaries* are either soft or solid.—The soft Electuaries are, the Treacle, Mithridate or Orvietan, the Confection of Hamech, that of Alkermes, the Catholicon, Diaprunum, Diaphænicum, Galen, Hiera Picra, &c.—The Solid Electuaries, are, among others, those of Carthamum, Rose-juice, Violet-juice, &c. which are also called Conserves. Mr. *L'Emery* reckons about 120 Sorts of Electuaries, some of which are to be renewed, at least twice a Year.

The Composition, Qualities, Doses, &c. of those Electuaries,

Electuaries we refer also to our *Pharmacopæia*, under the Letter P.

The *Syrups* are of Violets, of Roses, of Poppies, of Elder, of Wormwood, of *Capilli veneris*, or Maiden-hairs, of Lemons, (and these must be renewed every Year) Emetic *Syrups*, Lienteric, and Antinephretic *Syrups*; Chologogue, Phelgmagogue *Syrups*, &c.

Conservees comprehend all Kind of *Confects* both dry and liquid; whether of Flowers, Fruits, Seeds, Roots, Barks, Leaves, prepared with Sugar.—The most usual are those of Betony, Violets, Mallows, Roses, Rosemary, Kinorodon, &c.

Tablets or *Lozenges*, are those of Juice of Liquorice, of Althæa, or the Roots *Iridis Florentinæ*, &c.

Troches are those of *Coloquintida*, or *Albandal*, of Agarick, Liquorice, Nutmeg, Amber, Rhubarb, Capers, Myrrh, Roses, Camphor, Squillæ, Vipers, &c.

The distilled Waters are those of Angelica, Ani-feed, Baum, Carraway, Coriander, Cumin, Dittany, Fennel, Hyssop, Marjorum, Mint, Roses, Rosemary, Saffron, Sage, Scurvy-grass, Thyme, Cinnamon, Citron, Juniper, Lime, Orange, Peach, &c.—Which Preparations, are all to be treated in our *Pharmacopæia*.

A good *Apothecary*, who is jealous of his Character or Reputation, should never trust to others for the Preparation of his Medicines; but rather than buy them of Chymists or other Artists, endeavour to contrive in his own House, a Laboratory for that Purpose, like the honest *Joseph Clutton*, an experienced and skilful *Apothecary*, in *Holborn*, who prepares himself all his Medicines, and on whose Integrity, a Physician can entirely repose himself, for the Execution of his Prescriptions; that Gentleman has certainly all the good Qualities requisite in an *Apothecary*, for he is a very great Master of his Art, has a great deal of Judgment and Experience, is very charitable and compassionate, and wealthy.

Some Persons will laugh, perhaps, at this Qualification, though to be wealthy is certainly a very necessary one in an *Apothecary*; since it is impossible a poor *Apothecary* should defray all the Expences he must be at, if he will have his Shop stock'd with all that's good.—There is this Difference between a *Physician* and an *Apothecary*, that a *Physician* may be poor and very learned, when on the contrary, an *Apothecary* cannot be poor and a good *Apothecary*.—A poor one may, it's true, understand his Profession very well, but of what Service is that Understanding to us, if he has nothing to exercise it upon? He knows very well how to make good Medicines, yes; but he has nothing to make them with.—We must not despise Poverty, else what would become of us Authors! But we are not obliged to impair our Health, and endanger our Lives to promote it.—Therefore I would never encourage an *Apothecary* to set up Shop, till he be in a Condition to do it as it should be.—*London* is overstocked with those *Apothecary-shops*, whose whole Furniture, don't contain enough good Drugs to make up a Physician's Prescription. Their whole Stock consists, in some bad Mithridate, for Boluses; and a small Quantity of simple Waters, and Syrups, for *Juleps*; with which they deceive the unwary Rabble, by giving those Poisonous Medicines, some hard Names, they do not understand; and for which they often pay as much as if they were good; and let even the Price be ever so small, they are always too dearly bought.—I laugh, when passing before *Rock's Shop*, I see it crowded with People, whom I suppose to be tired of their Health, since they are so ready to destroy their Constitution, with his Poisonous *Nostrums*.—If such Shops were once suppressed, and Cobblers sent to their Stalls, or Porters to their Knot again, the honest, industrious, and skilful *Apothecary* would have more Business, and not be so much tempted to invade the Physician's Province.

The Prince of *Conti*, Grandfather to the present Prince of that Name, once upon the Road from *Dijon* to *Paris*, attended but with very few Servants, found himself indisposed at a small Village, and asking if there was some of the Faculty in the Neighbourhood he could send for, his Highness was answered, that they had in the very Place an *Apothecary* and *Surgeon*, rendered famous throughout the whole Country, for the vast Number of Cures he had performed, of which the *Orator* was going to make a long Detale, had not the Prince interrupted him, by ordering the famous Doctor to be fetched to him.—As it was pretty dark when he came, and his Highness in Bed, he could not so well take Notice of the *Physic* of his *Æsculapius*, who administered him some Remedies, which really did him a great deal of Good; for which the Prince, who was liberal even to Excess, ordered him fifty *Lewis D'or*, which was a Sort of Fortune for the Doctor, desiring to see him again the next Day, and that he should have the Honour to dine with him.—At Table, the Prince took a narrower View of his *Medecin*, and thought he had some Knowledge of that Face, but when and where he had seen it, was what he could not call to Mind; therefore he asked *Æsculapius*, if he had not seen him somewhere else; to which he modestly answered, that he had seen often his Highness, and that if he would give him leave to wait till after Dinner, when the Company would withdraw, he would take the Liberty to inform him where. The Prince granted his Request.—Accordingly, after Dinner, he informed his Highness, that he had been his Servant, and being asked in what Capacity, he answered, in that of Groom of his Stables. The Prince could not help smiling at the Odds of the Adventure, and asked farther, to whom he was indebted for so extraordinary a *Metamorphosis*, as was that of being changed from a *Palfermier*, or Groom, into an *Eminent Doctor*, and how he could have the Impudence to trifle with the Lives of the King's Subjects? He answered, that he was indebted to no Body, but to himself for his happy Change; that he had taken his Degrees in his Highness's Stables. That he had been very successful in taking Care of his Horses, and administering them Remedies, when they were disordered, and thought he could be as successful in the Cure of Men's Maladies, under the Supposition, that there could be no other Difference but in the Doses of the Remedies in which he had heretofore very well succeeded; and then bending his Knees, desired the Prince for God's Sake, he would not divulge this Secret, which no Body in the Place was acquainted with; for if it was once divulged, he should lose his Credit, and consequently a handsome Livelihood.—The Prince promised he would not; but if he ever heard that any Body died under his Hands, he would have him hanged.

We have a great many of those *Apothecaries* in *England* who have learned their Profession in worse Places than Stables; and have often deserv'd that severe Punishment the Groom of the Prince de *Conti* was threaten'd with by him, for the frequent Murders they commit, tho' they escape with Impunity, thro' the too great Indulgence of the Legislature; 'tis surprising we are so well armed against every Thing which could injure or endanger the publick Good, and we suffer patiently every ignorant Fellow to rob us of our Lives; which with our Liberty are the dearest and most precious Things we enjoy in this World. This may be attributed to the Indolence of Physicians, in neglecting to use the Power they have by their Charter, to search the *Apothecaries* Shops in and about *London*, to see if their Drugs be wholesome, and their Compositions according to the Form prescribed by the College in their *Dispensatory*.

Bartholin complains of the too great Number of *Apothecaries* in *Denmark*; tho' there are but two allow'd in all *Copenhagen*, and one in each considerable

derable Town.—What would he have said of *London*, where there are upwards of 1300; and half of them with no other Talent, but Ignorance and want of Experience, supported with a great deal of Impudence and Affectation.

To his Majesty belong two *Apothecaries*; Salary to the first is 320*l.* the second 275*l.* to the Household belong also two.—The Princes and Princesses have also their *Apothecaries*, which is a new Addition of Merit in the Person preferred to it.

APPARITIONS.

APPARITION is a supposed extraordinary or phantastical Appearance of some created Being, which cannot be rendered visible, but by a Miracle of the Creator.

Of these there should be two Kinds, one of spiritual Existences, which have always subsisted as such, and independently of a corporal one, from the first Instant of their Creation, such as Angels, Devils, &c. and the other of spiritual Substances also; but which, for a certain Time, have been intimately united with a corporal one, from which, by the ordinary Course of Nature, they have been separated at last.

Apparitions of the first Kind, remain uncontroverted, especially among *Jews* and *Christians*, both authorised therein, by several Passages of the *Old* and *New Testament*; whereby we are informed, that God himself, and the Angels have at several Times, and in different Shapes and Forms, appeared to *Moses*, and to all the antient Patriarchs; in the *New Testament*, *Mary* is visited by an Angel; *Christ* is comforted by one, during his Agony in the Garden; he is tempted in the Desert by an Evil Spirit, &c.

Apparitions of the second Kind, are also frequently mentioned in the same Holy Writ. The Prophet *Samuel* appeared to *Saul*; *Christ* himself appeared to his Disciples, several Times after his Resurrection, in the same Nature, his Divine Essence had been hypothetically united with, while conversing with Men upon Earth; and in the same Body, since he bid *Thomas* to put his Hand in the Place of the Nails which had fixed him upon the Cross.—At *Christ's* Death the Monuments or Tombs were opened, and several of the Bodies, which had been buried therein, arose, and appeared to several in the City of *Jerusalem*.

These *Apparitions* of both Kinds, seem to have been of an indispensable Necessity, in the different Epochs assigned to them by the Holy Writ. Those to *Adam* in the Garden, (if really God had appeared to him under any Form or Shape) or if he only let him hear a Voice, which is the most probable; and which, nevertheless, may be reckoned a Sort of *Apparition*, were necessary to instruct *Adam* in his Duty, or to reproach him with his Crime, after he had sinned.—*Moses* is positive that a *Cherubim*, with a flaming Sword, was placed at the Gate, after *Adam's* Expulsion, to guard the Entrance of the Garden.—That *Abram*, or *Abraham*, received Angels under a human Figure, is clearly related in the *Genesis*; whereby we are informed that those Angels were sent to foretel the Birth of *Isaac*.—*Moses* assures us, that he saw a burning Bush, and heard a Voice from it, which served to strengthen his Faith, and prepare him for his Mission into *Aegypt*.—*Jacob* saw the mysterious Ladder, and wrestled with an Angel, which seem'd necessary to confirm to him that Right of Primogeniture, which had been transferred to him by a supposed *Superchery* of *Rebecca*.—God appeared to *Moses* amidst the Thunders and Lightnings of the Mount *Sinai*.—*Samuel* appeared to *Saul*, to forewarn him of his approaching Overthrow and Death.

This last *Apparition*, seems to be of another Kind from those heretofore mentioned; and has much puzzled the Interpreters of the *Holy Bible*; in Effect, this History is almost above the Apprehension of a Christian Mind, that the *Pythonefs*, could by her *Enchantments*, have brought forth *Samuel*, a holy

Prophet, who while living, had been the sacred Repository of God's most profound and unscrutable Secrets; who had been the faithful Interpreter of his Intentions, and irrevocable Oracles; to whom he had committed the Conduct of his People for so considerable a Time, and who had so faithfully discharged that great Trust. A holy Man, who when full of good Deeds and Years, had peaceably slept in the Lord, and whose predestinated Soul waited with the rest of the Elect, the Resurrection of the first among the Mortals, to accompany him in *Heaven*; how is it possible that Enchantments, whose Practice had been forbidden by the Law of *Moses*, as contradictory of the irrevocable Decrees of Divine Providence, and concerted only by the Devil, for the Deception of weak and superstitious Minds, could have been of any Effect on this Occasion? Can it be imagined that a Soul, which was then under God's particular Care and Protection, could have been under the Directions of a Magick Art, and forced to obey the Infernal Commands of a Witch? Or can it be supposed that the Omnipotent, who by his wholly irresistible Power, could have procured the *Apparition* of *Samuel*, would have had Recourse to illicite, or rather criminal Enchantments for it? Therefore nothing else but a sacred Authority could persuade us of the Truth of that *Apparition*, which under the Light of the Gospel would be considered by a truly Christian Mind, as an Imposture.

The Different *Apparitions* of *Christ* after his Resurrection, were indispensibly necessary, for to confirm his Apostles in their tottering Faith, as well as those which happened at his Death in *Jerusalem*, for to witness his approaching Resurrection; but we have heard of no other *Apparition* since, which could be supported by such Authority.

If we believe the Christian Histories, especially those which have the Sanction of the Church of *Rome*, there are very few holy *Personages* of that Church, especially those who for their exemplary Life, extraordinary Piety, Virtue, Abstinence, &c. have deserved a Place in the Calendar, as Saints, who have not been favoured, while living, with some *Apparitions* from the Hosts of Heaven; but more particularly, ever since the Institution of religious Orders.—If we believe the *Bernardin* Monks, and the *Dominican* Fryars, St. *Bernard* and St. *Thomas*, were frequently visited while living, by the Virgin *Mary*.—St. *Francis* the Patriarch of the *Franciscans*, received the *Stigmates*, or Marks of the Wounds of *Christ* in his Crucifixion, from a *Crucifix*, which appeared to him upon Mount *Alverni*.—But those *Apparitions*, to a Protestant Mind, appear fictitious and Chymical; neither are they Articles of Faith among the *Roman Catholics*; they know very well, that nothing is above the omnipotent Power of God, who can, when he pleases, distinguish his Elect from the rest of Mankind, by some extraordinary and particular Marks of his Favour; but they know also, that all that's related to them of those *Apparitions*, are not Articles of Faith; and that there is no greater Crime in questioning the Truth thereof, than in that of believing it.—Those Sorts of Histories are often invented to engage the vulgar and the ignorant to the Practice of Piety and Virtue; since those holy Romances, and the Hope of receiving, perhaps, the same Favours, if they follow the same Course of Life, make a deeper Impression on their weak Minds, than the most eloquent

and pathetick Discourse of the best Orator. Therefore I don't see that there is any Crime to entertain them with those plausible Stories of divine *Apparitions*, which serve to promote a religious Life. The most strict among the Protestants, approve of a Romance, interspersed with frequent Incidents, and judicious Reflections, conducive to Morality and Virtue; why not those Histories of *Apparitions* which are filled with nothing else? For though I don't think myself obliged to believe any Kind of *Apparitions*, but those authorised by the *New Testament*, and which I must believe as a Christian, (and really I believe no other) however, I don't think it a Crime to suppose some others real or fictitious, for the Purposes heretofore mentioned.

Besides, it is almost impossible, that the History of those pretended *Apparitions*, should have a vitiated Origin, or a criminal End. Nay, I will even go further, and suppose, that the Historians have been mistaken themselves, and wrote upon Memoirs which they thought Authentick, and perhaps received their Information from the Person himself, who pretended to have been favoured with those holy *Apparitions*, who also could be excused from Imposture or Falshood; since it is very possible, that in the extatick Raptures of his Devotions, while his Imagination, and all the other Faculties of his Soul, were seized with an excessive Desire of possessing the divine Object beloved, he might have mistaken, then, an Extasy or imaginary Presence of the Object, for a real one; and to this alone I attribute almost all other *Apparitions* which have happened at different Times, and in different Ages, from the Beginning.

Some are of Opinion, that the *Apparitions*, or Visions of the antient Prophets, were nothing else but Dreams of this Kind; that God has never been otherwise visible to them, or manifested himself to them, but during their Extasy, and in this Manner; that his divine Voice, so often mentioned in the Scripture, to have been heard by them, was nothing else, but a special secret Inspiration, very little different from the Motions of an efficacious Grace; that to be more attentive to those secret Inspirations or Motions, they separated themselves from the rest of Mankind, and retired into Desarts and Solitudes, where, far from the Embarras and Tumult of the World, they applied themselves wholly to the Contemplations of the divine Attributes; which Contemplation silenced all their Passions, and made them almost forget their Mortality, thereby to render them the more capable to listen with a serious Attention, to the sacred Dictates of the divine Sapience; that thus in a Manner separated from themselves, and in a perfect Extasy of all the Faculties of their Soul, they really thought they possessed what they desired to possess, and to have seen what they wished to see. That the Ideas which they had formed, during those Raptures, had so entirely seized their imaginative Faculty, that when returned to their natural State or Condition, they could not persuade themselves that they had been in a Dream.

Such were, say they, all the *Apparitions* or Visions, *Moses* mentioned he was favoured with in the Desart.—In that Manner, and no otherwise he received the Decalogue upon *Mount Sinai*, was directed in the Conduct and political Government of the *Israelites*, in the Ceremonies of the Tabernacle, and in the Rewards and Punishments.—Thus was *Elias* sent to *Abab's* Court, and advised to fly from it.—In that Manner *Samuel* was directed at one Time to anoint *Saul* King over *Israel*, and at another, *David*.—And thus the Holy Ghost is said to be the Author, and to have dictated the holy Writs; for, continue they, if it is expressed otherwise in the Scripture, and said positively, that *God* spoke or appeared, it is for no other Reason, than to render the Style more pathetick, and more familiar to us, which otherwise had been too metaphysical, and above the common Apprehension of human Understanding; since it is a great deal easier to conceive, that *God*

appeared to the antient Patriarchs and Prophets, under a human Shape; and thus *habited*, spoke to them, than to say between his divine Essence, and their spiritual Faculties, there was a certain Communication of Thoughts, which is incomprehensible; and they conclude at last, by saying, that this Communication was no otherwise sensible, than that between him and the Blessed in Heaven; who, though they are said to see *God* Face to Face, to sing his Praises, and to converse with them, see him nevertheless, no otherwise than as a spiritual Substance can see, that is to say, in a Contemplation of his divine Essence, more perfect than they were capable of, while their Soul was enslaved in a mortal Body, and disturbed or agitated by the continual Conflict of their several Passions.

Mankind, who have a natural Penchant to Evil, and are never better pleased, than when they can contribute towards disturbing their temporal Tranquillity, have invented, since, another Sort of *Apparitions*, such as those of *Evil Spirits* and *Spectres*. Their vitiated Imagination goes often into Hell, to bring from thence the apostate Angels, under different Shapes, and always the most hideous; and therefore the most capable to terrify their fellow Creatures.—They also penetrate into the Obscurity of the Tomb, and by disturbing the Silence of those sacred Repositories of the last Rags of our Mortality, and raking those Ashes, (which the divine Creator had designed should rest peaceably, till by a new Miracle of his Omnipotence, he would be pleased to moldize that same Clay, once animated by him, into a new Form) they have the sacrilegious Presumption to anticipate his irrevocable Decrees, and to form *Phantoms* of what's never to appear but once more, and in Reality.

'Tis true, that the vulgar Error of this Kind of *Apparitions*, has prevailed among all Ages, and among all Nations; that the *Romans* themselves, at that Time the most learned and most judicious People in the Universe, have been infatuated with that ridiculous Notion; that among the vast Number of ridiculous Stories of that Kind, related by their Authors, is that of the Sepulchres at *Rome*, having opened their ponderous Jaws, and vomited the Dead confined therein, who appeared publicly in the Streets, a few Days before the Assassination of *Julius Caesar* in the *Senate*; and this other of the same *Julius Caesar* appearing to *Brutus* a few Days before the Battle of *Philippi*, are two of the most flagrant.—The *Greeks*, their Predecessors in Learning and Strength of Judgment, had also been susceptible of the same ridiculous Notions; and their Poets have painted in the most hideous Colours, the Ghost of *Laius* King of *Thebes* haunting *Oedipus*, from almost the first unhappy Day of his incestuous Marriage, to that of his unhappy Catastrophe.—The *Jews* were perhaps the sole Nation which has appear'd the least guilty of it.

It may be objected that this Error does not proceed from so poisonous and infected a Source as might be imagin'd; that it was perhaps first invented with no other Design than to confirm the Vulgar in the Immortality of the Soul, which otherwise must have been above their Apprehension; that it was easier to convince them by such plausible, tho' fictitious Demonstration (since they are seldom inclinable to believe any Thing else but what falls under their Senses) than by metaphysical Reasoning on the Essence and Subsistence of the Soul; that the supposed Relations made by those who could be suppos'd to have experienced it, of Virtue being rewarded, and Vice punish'd in another World, were more persuasive to induce them to practise the one, and avoid the others, than all the Exhortations from the Pulpit, or from other Places appointed for such Exhortations. That the Fear of seeing the Devil under such hideous Shapes as he is represented in his *Apparitions*, could deter the Vulgar from having any Communication with him; and the Inquietude a departed Soul was

suppos'd to be in, if guilty of some capital Offence, at the Time of his Departure, obliges his Descendants to reform their Manners, and follow a Course of Life quite opposite to his.—That at least these are the Reasons, which in all Probability have engaged the Christian Church to tolerate the vulgar Error of *Apparitions*.

These Reasons, I must confess, could in fact palliate, or disguise that Error, if such Error was indispensable for the publick Good; and if we had no other Inducements to Virtue, than the mercenary Hope of a Reward, and the dreadful Apprehension of the most severe Punishment. But the sacred Style in Praise of Virtue, is attended with such Unction, and with such particular Grace from above, that it is vain and ridiculous to suppose, that a fictitious Expedient could accomplish what, thro' our Obstinacy and criminal Resistance, it could not conquer. As for the Immortality of the Soul, it is so clearly stated in all the sacred Books, and so well confirm'd by *Christ's* Resurrection from the Dead, that we must have renounced all Principles of Religion to deny it; which if we do, it is not a Romance which can rectify our Faith on that Article; therefore it is surprising to me that the monstrous Doctrine of *Apparitions*, is not even tolerated (as a necessary Evil which has so deeply corrupted, or vitiated our Minds, as not to be easily extirpated) but even countenanced by the christian Clergy.

For I'll take the Liberty to ask, if the Doctrine of Apparitions, Visions, Spectres, Phantoms, &c. is not repugnant to a Christian Belief? Which to prove (and at the same Time do it with some Order) I'll begin with infernal *Apparitions*.—But before we proceed to those Proofs, we must have Recourse to some general Observations absolutely necessary to give us an Insight into the whole.

1. That the Devil, which in those *Apparitions* we are pleased to represent as a sort of Monster, half Man and half Beast, with Horns, a Tail, cloven Feet, &c. has a spiritual Substance, and incorporeal Subsistence, *i. e.* that he essentially and substantially exists without the Concomitance of a corporal Form, and abstracted from the Matter.

2. That his spiritual Existence, answers all the Purposes he is design'd for, ever since his Fall. Which are of his being sensible of his Punishment, of being permitted to be the Tempter of Mankind, and appointed Minister of God's Justice; and which can all be done, without his being obliged to borrow a visible Form; for 1st, as his Torments were prepared for the Punishment of a spiritual Substance, he suffers in his spiritual Substance, and no otherwise. 2dly, His Temptations being only to affect the Mind, which is equally susceptible of visible and invisible Impressions, a hideous Appearance, capable alone of keeping it in Awe, would captivate the Liberty, and frustrate the Design of the Divine Providence, which permits we should be tempted, that thereby the Grace he is pleased to assist us with, at those critical Moments, acting in concert with us, might gain a greater Victory on the Efforts of our common Enemy.

3. That God gives to the Devil but a negative Power over us, *i. e.* that he suffers we should be tempted by him, but does not command we should be tempted, and never suffers we should be tempted above our Strength,—*qui non patietur vos tentari supra id quod potestis*.

4. That the same Supreme Being has reserved to himself the entire Disposal of our Soul, leaving us only the momentaneous Use of its Faculties.

5. That could the Devil assume a visible Form or Shape, he could not do it without God's special Order, and to serve some particular End of the Divine Providence, but what could be those Ends which could not be answer'd by the Devil's spiritual Existence, is what no true and reasonable Christian can imagine.

Therefore we must draw from the foregoing Premises, this necessary Conclusion, that as the Devil's

Apparitions would prove vain, and without any Meaning or Design they are not to be supposed; that being not absolute Masters of our Souls, we cannot sell them, or dispose of them to the Devil, on any Consideration whatever. That by the infernal Secrets of the Magick Art, by Enchantments, or Fascinations, we might perhaps deceive ourselves or others, but never have that Power to force the Devil to assume a visible Form, which visible Form has never had other Existence, but in the depraved Imagination of some *Antoufats*, Fanaticks, and Visionaries. Since the Scripture itself, when it mentions *Christ* being tempted by the Devil, or the Devil being expelled by him from the *Energumeni*, mentions it always as a Spirit, without Form or Shape.

Another Error almost as bad as this, is to suppose the Apparitions of deceased Persons: Which has prevailed so far, as to gain Credit even among Persons of Piety, Sense and Learning; who are infatuated with it to such a Degree, as, in their Opinion, it would be a Sort of Impiety to revoke it in doubt. Therefore let us consider seriously, and without Prejudice, if it is agreeable to the Principles of their Religion; as for our Reason, it has little or nothing to do with it.

But to proceed likewise with some Order in this *Examen*, we must consider Christianity in the different Manner it is practised by its Professors; or rather divide the Christians into two Classes, *viz.* into those who admit of a third Place, between Heaven and Hell, and those who deny such Place.

If we consider seriously the Principles of those who admit of a third Place, I mean, what's called a Purgatory, we shall find that the Doctrine of *Apparitions*, is not quite contrary to those Principles; for if it is true, as they pretend, that the Detention of the departed Souls, in that Place, is but transitory, *i. e.* till they be entirely purged of the small Imperfections they are departed with, and render'd fit to enter the Kingdom of Heaven, (which admits of no Impurity whatever) if it be equally true, that the Prayers, Fasts, Alms, &c. of the Living can shorten the Time of their Confinement, or break their Chains, and open the Gate of their Prison, it is agreeable enough to our Reason to suppose, that they being sensible of it, would endeavour, if possible, to put all in use to procure themselves those salutary Means, whereby they are to be delivered of their Captivity, and reunited for ever to their Supreme Being; that God, in whose Peace they are departed, and who wish for their Deliverance, would not refuse them to use those Means, even so far as to approve of their *Apparition* to the Friends they had left behind them, in order to excite their Zeal and Compassion, and engage them to the Practice of those Acts of Piety, on which depend the Deliverance of those imprison'd Souls.

But if on the other Side we adhere to Protestant Principles, which admit of no such Place, (but on the contrary conduct immediately the departed Souls into Heaven, or condemn them to Hell) we'll be obliged to reject the Doctrine of *Apparitions* as chimerical and fictitious; for if, according to one of the chief Articles of our Faith, the Felicity of the Blessed in the celestial Mansions, and the Unhappiness of the damn'd Souls are to be eternal, which Eternity implies no Interruption, otherwise it would be no longer an Eternity; if further the Protestant Doctrine refuses the Blessed the least Knowledge of what passes here upon Earth, what could induce them to quit Heaven to come here among us? The temporal Peace or Tranquillity of a Family or Friends, which perhaps they have left behind them in some Disorder and Confusion? But would not that single Reflection, we suppose them capable of, be an Interruption of their Happiness, which from that Instant would cease being eternal; besides the apparent Contradiction of a Protestant Doctrine, that the Blessed know nothing of what passes here among us.

Another Objection against the *Apparitions*, which is yet stronger than any of those abovemention'd, and

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even taken from our Manner of reasoning on *Apparitions*, is, that we make those Souls alledge for Reason of their Appearance, that they could not have rested if they had not appear'd to such, and such Purposes; but is it not an Impiety to suppose, that there could be some Inquietude to be met with in Heaven; is not that a monstrous Contradiction, that the Peace of the celestial *Jerusalem*, is eternal and unalterable, as it must be to compleat a perfect Happiness, contrary to our Faith, and to the Notion which *Christ* himself has given us, while conversing upon Earth of the Kingdom of his Father?

But however I'll suppose, for a Moment, these *Apparitions* of the blessed Souls to be true, and contrary to the Protestant Principles, that the Blessed in Heaven know our Jars, Disputes, Inquietudes, &c. and are disturb'd at it, which cannot be done, without assuming some Form or other. Therefore what sort of Body do they form at that Time? Their own? that cannot be, since it would be a Resurrection of that Body, which would render *Christ* guilty of Falshood; who has assured us, that there would be no other Resurrection than the general one. Perhaps it is an ethereal Body? But let it be what it will, it must be some corporal Substance, else it could not be visible to us, walk, speak, &c. as *Apparitions* are pretended to do; if it is a Body different from the former Body, then that Soul has inform'd two Bodies; therefore what becomes of that Body when the *Apparition* is over; is it annihilated, and if it is, what Partiality, what Injustice, that a Body which had been dignified once with the Information of a blessed Soul, should enjoy his Happiness but for few Moments, and afterwards return into its former Nothing?

Perhaps it is not the Soul herself, but her good Angel that is sent on her Errands? The same Difficulties continue still, that the Inhabitants of the celestial Mansions are inform'd of what passes here among us, and are disturb'd with the Care of our worldly Affairs, which imply always the same Contradiction; but if even such Thing was possible, it would be ridiculous to suppose that God would disturb the Peace of his Kingdom, for to compose our Jars or Differences, to save a transitory Fortune, or discover hidden Treasure, and not do it to put us in a Way how to gain an eternal Felicity; for we never hear that those *Apparitions* are so kind to inform those they appear to of the Means how to obtain that salutary End.

But according to the very Notion we have of those *Apparitions* we must be obliged to deny, that it is either the Soul herself, or her Angel who appear, since we pretend that our Clergy has a Power to lay those *Apparitions*, or to confine them, some in the *Red-Sea*, some under the Threshold of a Door, and others somewhere else, and even to fix the Time they are to lay in those Places; which if it was true our Clergy would usurp a Power over God himself; for since those *Apparitions* do not walk (as we call it) without his special Leave or Order, to be capable of contradicting or opposing that Order effectually, would be an evident Mark of an Authority superior to that of the Almighty, and to fix a spiritual Substance in a Place, would be changing its Subsistence, which God himself cannot do; besides it would be another Judgment on that Soul, which has been judg'd already in *dernier resort*.

For my Part I cannot imagine how the Clergy can countenance such monstrous Notions, which smell so much of Impiety and Paganism; for it is but too plain that they countenance them, because perhaps they flatter his Vanity, which has always been one of his favourite Passions, otherwise we should see some of them, at least, endeavour to undeceive those of the Flock committed to their Care, who are weak enough to believe those *Apparitions*, and persuade them that such Error proceeds from a Pagan Belief, that the departed Souls hover'd, for a certain Term of Years, about the Sepulchre where the Body was deposited, be-

fore they could be receiv'd into the *Elysian* Shades; and that nothing but such ridiculous Notions could countenance the vulgar Error of *Apparitions*.

If we suppose that those who appear thus, are only Souls coming from Hell, and not from Heaven; such Supposition is as monstrous and as extravagant as the other; and to the full as contrary to the Principles of Christianity. For as those Souls are never supposed to come but on some just Errand or other, that very Notion of doing Good, or of Justice, is contrary to their Nature, as damned Souls, which if they could form the least Idea thereof, from that very Instant, there would be an Interruption in their Torments. Besides, even in the Pagan's Opinion, it is very easy to go into Hell, but it is impossible to return from it.

Therefore we must renounce the Error of *Apparitions*, or to render it plausible, admit of a third Place with the *Roman* Catholicks, and even then it will be still an Error; for if the departed Souls in *Purgatory* want the Succours of our Prayers, and other Acts of Piety and Devotion, to be released of this dreadful Prison; *God*, who knows their Want, has no need to have Recourse to such extraordinary Means, since he can excite us to Compassion, as effectually through the Efficacy of his Divine Grace, as by the frightful *Apparition* of those afflicted Souls.

Luther laughs at those *Apparitions*, and pretended that the Doctrine of the *Purgatory*, by which alone such Error could be countenanced, proceeded originally from the Avarice of the Clergy. But the *Roman* Catholicks will answer to that, that *Luther* spoke then through a Principle of Animosity and Inveteracy against a Church, he had but lately deserted, and that he was obliged to excuse his Apostacy under some Pretext or other; that though the greatest Part among them have no Notion of *Apparitions* of any Kind whatever, they don't see however why the Doctrine of a *Purgatory* should be rejected, which is only calculated for the Encouragement of Piety, Abstinence, Charity, and Devotion; that if even there is no such Place as a *Purgatory*, it cannot be a Crime to pray, to mortify our Flesh by Fasts and Abstinence, and to give Alms to the Poor; for if there are no Souls to be released from *Purgatory* by our Prayers, those Prayers cannot be criminal, since Prayers are the most essential Part of a Divine Worship, and thereby if they are of no Service to the departed Souls, they cannot be disadvantageous to us; if there are no Souls to be released by our Fasts and Abstinence, those Fasts and Abstinenes serve to keep the Flesh from revolting against the Spirit, according to the Advice of the Apostle *St. Paul*; and if our Charity don't hide the Imperfections of the Souls in *Purgatory*, they serve to hide our Sins, since *Charitas operit Multitudinem Peccatorum*.

Thus they speak of their *Purgatory* independently of *Apparitions*, to which the Protestants answer that those Acts of Piety and Charity may be effected without our having such Chimerical View; but I don't pretend to enter here into a Controversy on that Subject, which would be foreign to my Purpose. I'll proceed on that of *Apparitions*, which I suppose to be as prejudicial to the civil Society; as injurious to God's Providence.

In Effect, Children are terrified with that ridiculous Notion of *Apparitions*, often sooner than they are informed that there is a divine Providence, which over-rule all sublunary Things, and without whose positive or negative Concurrence nothing happens here among us Mortals; for were those unquestionable Truths first printed in their Imagination (susceptible then of the strongest Impressions) in the most lively Colours, it would be impossible afterwards to trace in the same Place that chimerical Phantom of *Apparitions*, which would vanish on the single Apprehension, that the Imagination would call then the other Faculties of the Soul, viz. Understanding and Reason to its Succours.—— A young Mind thus prepared would, at the sole Attempt of poisoning him, with

with the Error of *Apparitions*, would argue with himself in this Manner.—I have learned as soon as I had been capable of the least Apprehension, or of understanding any Thing, that nothing happens here upon Earth, but by the Order, Direction, or Leave of a Supreme Being; I have also learned farther, that the same Supreme Being never permits or does any Thing in vain; that all the *Phænomena*, Incidents, Events, &c. of this World are decreed by him, for some necessary End, all conducive towards his Glory, or our common Felicity, temporal or eternal: But what End could those *Apparitions* they attempt to terrify me with, be calculated for? To manifest his Power? Can it be manifested in a greater Manner than it has been in the Formation of this World, which I am told was created by him from nothing; and by the just Symmetry which subsists between every Part that grand Machine is composed with, which I am told likewise is an Effect of his supreme Wisdom? For our Instructions? If so, why so many Volumes dictated, as pretended, by the Divine Sapience himself, and where, 'tis supposed, we can find all that's necessary for our Instruction? To rectify some Mistake? But a Power unlimited, like his, must have several Expedients to rectify those Mistakes, without having Recourse to those preternatural ones, capable to revolt Nature itself. To terrify us? No; that's incompatible with his immense Goodness and Compassion; therefore that Doctrine of *Apparition*, being, in all Appearance, the Produce of the vitiated Imagination of some Visionaries and Enthusiasts, whereby they endeavour to deprave mine also, if possible, I must reject it as such.

Too happy, if our Parents would take Care to caution us thus against such ridiculous Infatuation, for then we would not find such Numbers of Christians, who having been entertained, in their Infancy, by some old Nurse or other with these dreadful Stories of Apparitions, who, when arrived at the Age of Discretion, recount the same Stories to others, as if they believe them true, with a more explicate Faith, than the chief Articles of the Christian Religion.

Another Inconvenience which attends the Recital of those Romances to Children is, that it terrifies them to Death, and damps their Courage ever after.—'Tis true, that they listen to it with a great deal of Attention, and seemingly with as much Pleasure, but the History is no sooner over, than they believe to have the Apparition at their Heels. I myself have seen some Examples of that Kind, especially while at the University, where an old Professor (otherwise very learned, but whom I really suppose to have been infatuated with that Notion of *Apparitions*) used to assemble at Night, just before Bed-time, all the younger Scholars he could, round him, to entertain them with Stories of *Apparitions*, and when the Bell rung for Bed, the Stair-Case was too narrow for them; for they crowded to get the sooner at the Top, that if it had been possible they would have been all foremost, and none behind; even sometimes some of them were afraid to lay alone; especially when the Ghost had appeared in a more frightful Shape than ordinary.

I remember once in particular, that while the *Ghost-Monger*, was very busy in bringing before his Audience, an *Apparition* of a monstrous Size and Figure, and the Audience very attentive to the Sight, the Place where they were having a Door to the Garden, some malicious Fellow or other had tied a leaden Weight to a Cord, which from one Pair of Stairs Window he let fall by Intervals against the Door. At the first Bounce, which was not a very small one, the Weight being pretty heavy, the Orator stopp'd, seeing the Countenance of his Congregation changed; but being recovered from that first Fright, after having concluded that it was nothing but the Wind, or something like it, he continued his Narration 'till another Bounce, louder than the first, threw again the Congregation, into a new and greater Disorder, and such, that they began to think of sending the most bold and courageous among them to see who, and what it was;

but while they were deliberating, every one of them, without excepting the Historian, having Modesty enough to decline the Preference, another dreadful Bounce ended the Dispute; for then, the Congregation and the Orator, among the Rest, broke into such Confusion, as if the whole other World had been let loose after them, and as if every one of them had had half a Score Ghosts at his Heels; nay the Deceit prevailed so far, that though the true *Apparition* discovered the Jest, some of the Audience would not be persuaded but that it was really a Ghost, supported therein by the Opinion of the *Ghost-Monger* himself; who has perhaps made since, and told at another Place a dreadful Story of that Jest, which however produced some good Effect, for afterwards they did not use to meet so often, and never since in that Place where the Noise was heard, which some of the Auditors averr'd to have been accompanied with Groans and Sighs, even to my Face, who must have known the Truth, since I was the real Ghost.

Our Ancestors were still more addicted to that Folly than we are, and to have attempted to turn the *Apparitions* into Ridicule, or prove them impossible, had been in the Opinion of some of them a Sort of Heresy; what surprises me most, is, that whole Bodies of learned Men have believed them true; and it is but lately that the Parliaments of *France* have rejected them as fictitious and chymical, that of *Normandy* excepted, which, as pretended, still continues to take Cognizance of them, founded, as it is said, on the following Story.

That a younger Brother, of a noble Family in that Province, inspired with the Desire of visiting Foreign Parts, having left his native Country, when yet very young, and absented himself, for very near thirty Years, tired at last, of his Rambles, returned when the least expected, more freighted with the long Relations of his Voyages, than with Money; bringing along with him a faithful Servant, who had accompanied him in all his Adventures, perilous and others.—The greatest Misfortune he met with at his Arrival was, that he found no nearest Relation living but an eldest Brother, who had more Wealth than Tenderness, Compassion, and good Nature, to whom our Traveller being obliged to apply for a Maintenance, found by first feeling his Pulse, on that Account, that it did beat but very low in his Favour; for he was reproached then with his Extravagancies; and with having spent his *Legitime*, in his Rambles.—The eldest Brother added to this first Compliment another, which though a little less Turk-like, did not however, promise a greater Relief to our penurious *Prodigal*; *i. e.* that he the said elder Brother had a large Family to provide for, and that he could not in Honour or Conscience rob them, to supply his Wants; but however not to leave him quite destitute, he had a handsome House in the Country very well furnished, and which could not be inhabited, because haunted by Spirits; that if he thought he could have Courage and Resolution enough to live in it, he would give it him with all its Appurtenances, as Gardens, &c. except the Estate, belonging to it, on which he should have only the Liberty of hunting.

Our Traveller, who then considered Hunger or Famine, as a still greater Devil, than the Devil himself or his emissaries, accepted the Gift, with a great deal of Joy and Pleasure; and soon after departed with his faithful Servant for his new Habitation.

At his Arrival he found, as his Brother had represented it, a very commodious House, and with very handsome Apartments.—When they had taken a View of the whole, their next Care was to provide a Supper, which after some Turns in the adjacent Fields, they found at the But-end of their Gun.—After Supper, our new Guest expecting a Visit from the other World, as his Brother had promised him, ordered his Servant to make up a good Fire, to light two Candles, to retire to Bed and leave him alone.—The Servant had not long obeyed those Orders, before our intrepid *Don Quixot* heard something stirring

ring at the further End of the Room, towards which, turning his Head, he saw coming forwards a tall Gentleman, of a very gracious Aspect, and dressed in Scarlet; at whose Appearance, our Knight Errand got up to reach him a Chair, which he placed on the other Side of the Table, opposite to him; for he did not know, had he placed him nearer, how the Air of the other World had agreed with his Constitution.—While the Visit lasted, there was between them two a certain mute Conversation, which had perhaps diverted those who had seen it, without being engaged in it; all passed in dumb Signs between them; for though our Traveller was, in all likelihood, Master of several Languages, I must however, suppose him a perfect Stranger to that spoken in the other World, to learn which, I cannot think he had ever any great Inclination.

The Time the Ghost designed in his Company being expired (not at the Crowing of the Cock, or at the Approaches of the Morning Dew, for my Memoirs mention neither of those two Circumstances, which always hasten the Departure of a Ghost; for on the contrary, they seem to hint, that the Evening was not yet very far spent; and as for the Cock crowing, I do not believe that there was yet a Cock or Hen in the House) the Ghost got up (for it was certainly one, as you'll see by the Sequel) and laying hold of a Candle, made a Sign to our *Don Quixot* to follow him; the Knight, who was too polite to affront his Guest, by a Refusal, and too intrepid, likewise, to shew the least Mark of Fear or Terror, accepted the Invitation, and taking the other Candle, followed the Ghost, who returned the same Way he came.—At the first Passage or Door, our valorous Champion was offered the Precedency, *i. e.* to pass first, but as he was a *Norman*, and not a *Spaniard*, and was resolved to do the Honours of his House, to the End, declined the Compliment, not through Fear of some unlucky Knock or Kick from the Ghost, in Case he had gone before him, but only because it was not the *Custom of Normandy*, and that's enough.—They went both in the same Manner, the one complimenting, and the other returning the Compliment, till they arrived at a small square Room under Ground, where the Ghost stopt, and putting down his Candle in the Middle, (for we must observe that the Room was unfurnished) pointed to the Place where the Candle was fixed, and vanished.—If our *Don Quixot* was pleased to be rid of his Guest or not, is a Circumstance which our Memoirs are deficient in, but as it is not a very essential one, we'll wave it, and content ourselves as they do, with the simple Narration of the Fact; which is continued thus:

As soon as the Ghost was departed, our Knight who had traced in his Memory a faithful geographical Chart of the Places he had passed thro' in his Travels with the Ghost, return'd back the same Way to his Apartment, and awaking his Servant, order'd him to go look for Pickaxes and Shovels, for they must go to work all the rest of the Night, (the Necessity he was reduced to, and the Pointing making him suppose that he had discover'd some Treasure, for he might have learn'd in his Rambles, that there are some of those Ghosts of a very liberal Disposition) and to work they went, and according to his Expectation, he found an immense Treasure in the very same Place the Ghost had pointed; and well it happen'd then that he had to encounter with a valorous Knight, for if it had been with a Parson, who by his Exorcism, had laid him perhaps in the *Red Sea*, or for want of Room there (for that Sea must have been even then pretty full of Ghosts, considering the vast Number which had been laid there) amidst the Ice of *Greenland*, that Treasure would perhaps have still been entombed in the Bowels of the Earth.

But I don't perceive that these Reflections hinder us from seeing our *Grasus* elevated, or rather blinded with the too great *Eclat* of his immense Wealth

posting to his Brother to inform him of it; the Brother laid Claim to it as found upon his Territory, the Discoverer was not willing to relinquish it, on any Consideration whatever. From thence ensued a Law Suit, which was carry'd before the Parliament of *Normandy*, and decided in Favour of the Discoverer; on Consideration that his Brother having given him the Place, and all that belong'd to it, he could lay no Claim to what was found in it. Besides his having exposed himself to very imminent Dangers for it; adding likewise, that in all Appearance, the Ghost had design'd the Treasure for him, who could have had the Courage to face him.

This History is recounted as a Fact, and alledg'd for a Reason, why the Parliament of *Normandy* do not condemn the Opinion of *Apparitions*; but it might be a Fact, without its pleading in Favour of *Apparitions*, since Necessity, which is the Mother of Invention, could have engaged our penurious Gentleman to ferret all the Corners of that antient House, and in that curious Research, it is very possible, he might have discover'd that Treasure; which for fear of his Brother laying Claim to it, making use of his ridiculous Notion of that House being haunted, he pretended to have found in that extraordinary Manner; and it is also as possible, that the Parliament of *Normandy* had guessed the Truth, but that knowing his Want, and the Inhumanity of his Brother, they pretended to believe his History of the *Apparition*.

It is related in the Life of St. *Athanasius*, Patriarch of *Alexandria*, that his being accused by the *Arians* of having poison'd one of his Deacons, and having no other Way left to refute that atrocious Calumny and prove himself innocent than by Miracle, he went, accompany'd with a very great Concourse of People, to the Sepulchre, where that Deacon had been bury'd, and calling to him with a loud Voice, desired him to appear to clear his Innocence; the Deacon obey'd his Prelate, rose from his Tomb, and proclaim'd *Athanasius* innocent of the Crime alledged against him.—The Author adds farther, that *Athanasius*, in Gratitude for so signal a Service, ask'd the Deacon, if he would have him pray that he should remain alive; to which the Deacon answer'd, that being secure of his Salvation, he would by no means return into the World, where he should be exposed once more to the same Temptations which renders it uncertain.

This History is the more Apocryphal, because it supposes, that St. *Athanasius* had no other Means left to prove himself innocent; which is false, since the Physicians, and all the Friends of that Deacon, had brought undeniable Proofs, that he died of a natural Death; and if even it had been otherwise, the Emperor himself being an *Arian*, as well as at that Time, the greatest Part of *Alexandria*, would not have been convinced by that Miracle of St. *Athanasius*, whom they accused likewise of being a Sorcerer, and a Magician.

Father *Maimbourg* in his History of the *Croizades*, relates, that while the Christians were besieging *Ptolemais*, one *Engelram*, a French Nobleman, who had accompany'd the Count de *St. Paul* in that War, and had been killed before that Place in a Sally of the Enemy, appear'd to the Count one Evening, while he was undressing himself to go to bed; the Count, says the Historian, was startled at so unexpected a Visit, but however, as he was a Person of a great deal of Virtue, Piety and Courage, he was soon recovered from his first Surprise, and address'd the Ghost in these Words; *What, said he, is it you my dear Engelram whom I saw but three Days ago killed by my Side under the Walls of Ptolemais? Yes,* answer'd he, *I am that Egelram, whom you saw fall in that Action, but not dead, since those who fight under Christ's Standard, for the Glory of his Name, and the Advancement of his Religion, never die;—but howe-* ever, added he, *I am come to tell ye, that to-morrow before this Time you will be with me: And then* vanished.

vanished. The Count was not in the least daunted at the News; and was the more inclined to believe it true, since he was perfectly awake when *Engelram* appear'd to him, and he knew, that the next Day they were to give a general Assault to the Town, in which according to *Engelram's* Words, the Count was killed with a Stone from a Machine.

Father *Maimbourg* don't give us this Relation for a Fact; for he only says, that he has found it in the Memoirs upon which he has wrote his History of the *Croizades*; and that he leaves it to our Discretion to believe it, or not. Therefore, to take his Advice, I'll say for my Part, that I don't believe one Word of it, and that I look on this *Apparition*, as on all others of the same kind, as a Fiction invented in those Days, with no other Design, than to inspire the Christian Nations with Zeal for the Conquest of the Holy Land, since those who died in so glorious a Cause, were thus eternally rewarded.

In the Memoirs of the Count *de Rochefort*, we meet also with an *Apparition*, but very different from the last mention'd. The Count is pleas'd to tell us, (and all that he says is not Gospel) that three Friends, of whom, if I am not mistaken, he was one, had promis'd each other, that the first of them that should die, would come to inform the two others of what pass'd in the other World.—That soon after one of them was killed in a Duel, who mindful of his Promise, came one Night, if it was to *Rochefort* himself, or to another, is what I am not positive of, but however he came, and opening the Curtains of the Bed, where his Friend laid then, and asleep, he awakened him, and appearing all in Flames, which we must think was a very bad Sign, told him, that nothing was more true, than what was said here among us of the other World, that therefore he would have him mend his Life and repent.

If the Count himself, saw this *Apparition*, he very little minded afterwards, the salutary Advice, the Ghost his Friend gave him then, for we do not see, even by the Account himself gives us of his Life, which has always been a pretty licentious one, that he took any Care to reform it; therefore we may very well rank this Story among many others of his own Growth, which in all their Incidents and Circumstances are altogether as plausible; such as that his Father marry'd a second Wife who had been branded with the *Fleur-de-Lis*; of his Emission at Church, and his Mistress having taken notice of it to him, from the *ne pollutantur Corpora*, of the Hymn, for *Complies*, &c.

This *Apparition* is certainly the most absurd of any we have mentioned yet; first it had been a criminal Presumption in those Gentlemen to make such a Promise, which they must have known it was not in their Power to perform; since after Death we cannot form any other Acts of our Free-will than those of an eternal Love of God, if we are saved; which Love so entirely possesses all that Faculty, that it would be impossible for it to form any other Act; and if we are damned, as *Rochefort* gives us to understand his Friend was, we learn from the Parable of *Dives*, that God will not permit a Soul to return from Hell to inform the Living of what pass'd there; and really this is the first *Apparition*, I have ever heard of, which has brought us News from the other World; tho' the Ghost in *Hamlet* gives us some Hint of the Purgatory, but in a Manner as if he was afraid to say too much.

There is to be read in the ancient *Breviaries* for the Use of the *Carthusian* Monks, in the Office of St. *Bruno*, Patriarch of that Religious Order, the History of a dreadful *Apparition*; they tell us there, that a Prebend of our Lady at *Paris*, or some where else, who had been Companion in Debauchery with St. *Bruno*, before his Conversion, being dead; while the Priests were celebrating the dead Prebend's Obsequies in the Church, and he laying on the *Cataphalca*, when they came to the first Lesson of the third Nocturn, at these Words of *Job*, *Responde mihi quantas*

babeo iniquitates, &c. How many are mine Iniquities and Sins, &c. *Job* xiii. v. 23. the deceased Prebend rose from the *Cataphalca*, and said; to the just Judgment of God I have appear'd, have been judged and condemn'd; *Iusto Dei judicio apparui, judicatus fui, et damnatus*; and then laid down again; that St. *Bruno* who was there present, as assisting to his Friend's Funeral, was struck with such Terror, that from that Moment he vow'd to forsake the World; and soon after retired to *Grenoble*, where he laid the first Foundation of his Order. If the *Carthusians* have discovered since this to be nothing else but a mere Romance, they have expung'd it from their Breviary, and defaced all the Pictures in their Houses, where that frightful Scene was represented.

In all Appearance, the sudden Change of St. *Bruno*, who from the greatest Profligate, became in a very short Time, an Example of Piety, Virtue, and Abstinence, was the Occasion of this Romance, for in those Days nothing extraordinary could happen without a Miracle.

In my last Journey to *Rome*, I met at *Lodi*, at an Inn, which is on the Left-hand upon the Road, going to *Modena*, a French Gentleman, who entertain'd me with the Relation of an *Apparition* which he pretended had happened at that very same Inn.—He told me, that one of his Countrymen, a Gentleman of *Chalons* on the *Soane*, used often to take a Trip into *Italy*, and always to lodge, when at *Lodi*, at this Inn, whereby he had contracted a very intimate Acquaintance with an honest good natured old Man who kept it. That in his last Journey, he was surpris'd at his alighting at the Inn to see new Faces, and miss his old Landlord; that he could not help appearing uneasy at it, which being taken Notice of by the new Landlord, he told him, that the old Landlord was dead, but that he would find no other Difference in the Place, but on the contrary meet with still better Entertainment, if possible, and civiler Usage than while his old Landlord was living. All this could not hinder our Traveller from expressing his Sorrow for the Loss of his Landlord; but as it was too late to move his Quarters, he comply'd with the new Landlord's Request, and lodged there that Night, with the Design to continue his Journey the next Morning, for while his old Landlord was living, he used always to tarry some Days with him.

He supped that Night, as I imagine, but with very little Appetite, and went to Bed soon, and left some Fire in the Chimney, which makes me suppose it was in Winter, (though I saw no other Chimney there than that of the Kitchen, the Travellers if they want to warm themselves being obliged to set round a Kettle full of a Sort of small Coal Dust, which they stir now and then to give more Heat) but perhaps the House has been alter'd or rebuilt since the *Apparition*.

While he was in his first Sleep, he was awakened by some Body opening the Curtains of his Bed, and who was it but his old Landlord. Landlord, said he in a Surprise, *how came you here? I have been told you was dead.* Yes, said he, *I am dead, and those who keep the House at present have murdered me, and buried me in the Garden in such a Place; therefore if you have a Mind to do me a last Piece of Service, as you have been always very kind to me, you'll have the Murderers punish'd*; (if the Traveller was surpris'd to find that Animosity and Revenge continued even beyond the Grave, and that even departed Souls were sensible of it, is what's not come to my Knowledge) but however, he promis'd his Landlord, (whose Conversation and Presence were not perhaps so agreeable then, as they had been formerly) rather more than he asked, and, in particular, an ample Satisfaction for the Wrong done him. And accordingly, the next Morning he went to the Magistrate of *Lodi*, to inform him of what had pass'd the Night before between him and his old Landlord; upon which the Magistrate ordered that the Murderers should be seized,

feized, and the Garden digged up in the Place indicated by the Landlord, where in fact they found his mangled Body, which the Traveller had buried in a very decent Manner, after which he prepared for his Return into his own Country, laying aside all Thoughts of travelling any farther. The Night before his Departure, when he thought his Landlord must by that Time have been at rest, since he was bury'd, and his Murderers executed; he was very much surpris'd to see him again enter his Chamber. By our Traveller's Countenance, which was not then very pleasing, the Landlord could have easily judged that his second Visit was not so acceptable as the first; and in fact the Gentleman received him in a very rough Manner, and asked him, what he wanted more? Nothing, said he, but to thank you for what you have done for me. He who thought such a Piece of Complaisance and Civility very unreasonable, and could never have imagined those Punctilio's were in Fashion in the other World, told his Landlord, that he might very well have saved himself the Trouble of so long a Journey, as must be that of coming from one World into another, on so trivial an Account, and that he had thought it a far greater Mark of his Gratitude, if he had left him at rest.

The Landlord, who was not one of those insolent ones, who but too often think themselves as great as their Guests, and perhaps greater; but on the contrary, was a very modest Soul, as I have observed already, had perhaps excused himself, had he not feared that the Excuse had perhaps appeared worse than the Offence, therefore he thought it better to withdraw, but as he was near the Door (for in his *Apparitions* he behaved with far more Circumspection and Prudence, than any other Soul had done before him, and perhaps since, for instead of vanishing or disappearing at once, which is enough to frighten a Person out of his Wits, he always came in and went out at the Door) the Traveller called him back; Landlord, Landlord! said he, since you are so grateful, I have also a Favour to beg of you, which is, that you'll be so good to give me Notice of my Death, three Days before it happens (for we must observe here, that the Number Three, is always the favourite one, in all Relations of this Nature) The Landlord promised, that if he was permitted to do it he would; which Promise was much more modest and polite, than that of those three Fellows mentioned by *Rochefort*, who had not half the good Manners of our Landlord, though in all Appearance educated at the Court of *France*, but I suppose them to have been some of those *Petit Maitres*, who thought they could be as impertinent in another World as they are in this.

After this Promise, the Landlord departed for his Place, and our Traveller the next Morning for his Country. Where, for Fear of a Relapse some Time or other, into his old Fits of Rambling, he tied himself so fast to a rich Widow, that afterwards he had not the least Inclination to go farther than the Length of his Chain.—In her Arms he had soon forgot *Italy*, his old Landlord, and the Promise he had exacted from him; till one Morning early, at a Country Seat, where he was with his Family to pass the Summer Season, he heard, while in Bed with his Lady, somebody knocking at one of the Garden Gates, which opened into an adjacent Wood; he thought then, it was some Gentleman he had invited that Day to a hunting Match, and therefore called one of his Servants, to go and see who was there.—The Servant went, but saw Nobody, which made the Master believe that he had dreamed it.—But his Servant had no sooner left the Room, but he heard another Knock, which convinced him then, that he was not mistaken, and ordered his Servant back again to the Place, from whence he returned as wife as before; and while the Master and Servant were disputing the Matter, the one insisting that he had not been to the Place, and the other protelling he

had, the Master heard a third Knock, (always the favourite Number Three) which made him go himself to the Place, where to his very great Surprise, he found his old Landlord, whom he knew again, though many Years had elapsed since he had seen him last. Landlord! said he, with a very great Consternation, (for he guessed presently what was his Errand) yes Sir, reply'd the old Landlord, I am come to accomplish my Promise, and to tell you, that you have but three Days to live.—The Gentleman thanked him, and came back to his Lady, who seeing him in some Confusion, asked what could be the Occasion of it; at first he found several frivolous Excuses to disguise the Truth, but when he saw she insisted still, and he could disguise no longer, he at last told her the whole Story.—Some Wives, in our Days, had been very well pleased at the News, and from that Moment had thought of a Mourning, capable to set out the auctionable Piece of household Furniture to the best Advantage, would have liked, in a few Hours, such and such for a Husband, and then provided for the Funeral of this; but in all Appearance, this Lady was of the old Stock, and perhaps had been brought up under the Eyes of a discreet Mother, who had taken more Care to inspire her with Sentiments of Piety, Virtue, and Modesty, than with those of Vanity, Ambition, Pride, and Coquettry, (the sole Dowry which the Jilts of this Age bring to their Husbands) since she appeared in an Instant overwhelmed with an unfeigned Sorrow and Affliction, and drowned in Tears, endeavouring to persuade her Husband, that it was nothing else but an Illusion.—But the Gentleman remembered too well what had passed at *Lodi*, between him and his Landlord, whose Face he could yet remember perfectly well, for to have taken the Change; therefore he sent for the Parson of the Parish, whom he acquainted with the Apparition, and mean Time desired his Assistance, in preparing him for Death.—The Parson, who perhaps was not much inclined to believe *Apparitions*, and perhaps had never been called to lay any Souls in the *Red Sea* (though I have never heard that the *French* Priests send those Souls any where else but into Purgatory, where they leave them, without putting themselves to the Charge of making them travel further) the good Priest told him, that he did well to prepare himself for Death, since every Day of our Life should be a Preparation for it; but that he would not have him do it on the erroneous Pretext of the *Apparition*, which was only the Effect (as he supposed) of some Dreams, which had strongly affected his Imagination. But however, all the Force of his Arguments availed nothing, and the Gentleman persisted still in his former Opinion that he had seen his Landlord.—The first Day passed without his feeling the least Symptom of Death; the second the same; the third, not so much as the least Appearance of any Distemper whatever, so that at last himself believing that he had been mistaken, he sent, towards the Evening, for a few Friends to come and sup with him, and partake of the Joy of his Family for his narrow Escape.

While they were in the Height of their Mirth, a young Gentleman who courted a Daughter of his Wife, by a first Husband, and to whom he had forbidden the House, not thinking him a fit Match for her, thought this a very proper Time to see his Mistress, while the rest of the Family was employed otherwise, and accordingly he was introduced into the House, by some *Abigail* or other (we have missed observing that the young Spark was forbidden the House under no less Penalty, than of being thrown thro' the Window, in Case he was ever found in it.)—The Supper over, the Company, who knew that their Host, after the Fatigues of the three preceding Days, wanted Rest, separated soon, and the Host, transported to think that his Landlord had been mistaken in the Calculation of his *Ephemerides*, was willing to see his Guests, as far as the Door, and taking a Candle to conduct them, instead of following the ordinary

nary Passage, went through another Apartment, which was that where his Daughter in Law was with her Gallant, who seeing him coming to him unexpected, and thinking then that he was come with no good Design for him, thought that to prevent an evil one, he must be before-hand with him, and therefore to favour his Escape, drew his Sword, run him through the Body and killed him on the Spot, in which unhappy Catastrophe, the Landlord's Prophecy was accomplished.

This Romance is well enough contrived to frighten Children, and to lull others asleep, which was the Effect it had upon me, for I nodded several Times while my Friend was recounting it; and the single Narration is sufficient, without any Comment to shew the Ridicule of it.

I have known here, a certain intriguing Lady (esteemed a *Lucretia* by her Writings, but a perfect *Messalina* in her Conduct) who pretended to have seen several Apparitions. She boarded once at a House in *Westminster*, and persuaded the Mistress of the House, who had been the Widow of a Painter, but had married again an *Irishman*; that she saw every Morning her late Husband, walking at such an Hour, in the very same Dress the poor old Fool had told her several Times, he used to be in at those Hours, while living. It must be observed that at the same Hour, the young Husband used to transport himself from his Bed to that of our Visionary, and for fear of being caught in *flagrant Delict*, by the old jealous Wife, they had contrived this Apparition, to hinder her from getting up too soon, so that while covered over Head and Ears, she was in the greatest Agony for Fear of a Visit from her deceased Husband, our pretended *Lucretia*, and her Spark were spending theirs in mutual Embraces.

The same *Lucretia* related to me the Story of an Apparition, which I take to be of her own Invention, for her Ladyship had a very fertile Brain; and therefore take it to be as true as the *Westminster* one.—An *English* Country Gentleman, said she, married a Wife who had a very handsome Sister, whom he found the Secret to debauch, and got her with Child, which she concealed as well as she could till she was very near her Time, when her Brother-in-Law, her Gallant, under the Pretext of hiding her Shame, proposed to her the coming to *London* to lay in, which she readily accepted.—While she was on the Road accompanied with her Deceiver, she fell in Labour, at which he carried her out of the Road into a Wood, where he left her in the most deplorable Condition, and returned to his own House.—Soon after this horrid Piece of Villainy and Barbarity, his Wife died without Issue.—Seeing himself thus left alone, and feeling within very strong Remorses for his past Crimes, he resigned his Estate to his next Heir, and taking along with him a considerable Sum of Money, under pretence of going to travel abroad, he came to *London*, where he thought he was not known, having spent the greatest Part of his Life in the Country.

At his Arrival in Town, his first Care was to seek a Lodging in a very populous Place, thinking that it was the surest Expedient to pass unobserved.—He soon found what he wanted, agreeing with a Shopkeeper for a second Apartment in his House, for which he offered to pay a very extraordinary Price, on Condition that his Name should be concealed; that no Body should see him; and that they should take Care to send him one Meal a Day, at such an Hour, and no more.—Which was promised, and afterwards punctually enough executed.—He had two Rooms, a Bed-chamber and another, into which when the Servant came up to make the Bed, or on some other Occasion, he used to retire.

This Gentleman had a Custom which very few Landladies or Landlords like much in a Lodger, not for Fear of any Accident happening to him, but of disobliging the Furniture, and which was that of reading in Bed; accordingly the first Night he laid in his new Lodging, he had placed his Can-

dle upon a Chair at his Bed-side, and was reading very attentively, a Book (which I suppose, considering his melancholly Circumstances, and the Resolution he had taken to lead an anachoretical Life, to have been *Sherlock* upon Death, the Practice of Piety, or some other such holy Volume) when he saw a Woman entering the Room with a Child in her Arms, and who, when near the Bed, took up the Candle and set down in the Chair, holding the while the Candle in her Hand, and looking very wishfully, at our *Anachoret*, who knew presently his *quondam* Mistress; and had been very glad, then, she had known the firm Resolution he had lately formed, of receiving no Visit at all; expecting every Moment to have his Crime painted in the darkest Colours; in which however he found himself mistaken, for instead of those bitter Reproaches, a Woman thus injured could have been expected to have abounded with (since none of the Sex spare them, even for the least Appearance of an Injury) he found himself all on a sudden assailed with a violent Box on the Ear, apply'd so effectually as to make the Blood gush out at his Nose; which makes me believe, that this Apparition was of an extraordinary Kind, and that she had really Flesh and Bones, else she could not have apply'd so well *activa passivis*; though she had the Complaisance afterwards to wipe off the Blood she had spilt with her Handkerchief, and shewing it to her penitent Murderer, told him (for contrary also to the Custom of all other Apparitions, this spoke first, or rather spoke alone, since the Gallant who had also perhaps vowed *silentium perpetuum*, a perpetual Silence, like the *Cartusian Monks*, did not so much as attempt to speak one Word) that the next Time he should see that Handkerchief again, his End would be near at Hand; giving him thereby to understand, that this would not be her last Visit; and in Fact she visited him every Night afterwards, but without Blows, contenting herself to set near his Fire, to undress and dress her Child, without speaking a Word, which the Hermit was so well used to, at last, that he expected every Night her Visit at such an Hour, as he would have done that of a particular Friend.

I asked *Lucretia* how she came to the Knowledge of this, she said, that a Gentleman having taken the first Floor in the same House, and hearing some Body over him, walking up and down, and having never seen any Lodger in the House, besides himself, asked once his Landlady, who could be that invisible Rambler? The Landlady, who like the Rest of her Sex, was glad to find a Person so kind as to help her to keep her Secret, told the whole Story, desiring, at the same Time, her Lodger, according to Custom, to divulge it to no Body else, for if he did, she should be ruined, since the Hermit was a very great Help towards maintaining her Family; who, if he was to hear it was known that he was there, would that Instant quit her House.—The Gentleman promised he would not; though he was not so good as his Word, for he watched the Opportunity one Evening when the Maid was going to make the Hermit's Bed, to creep up Stairs after her, and forcing into the Bed-chamber, obliged the Hermit, by his Importunities, to open that where he had retired; and after some Excuses, entered into a Conversation with him upon his extraordinary Manner of Living.—The Hermit discovering by his Guest's Discourse, that he had a great deal of Honour, and Probity, made no Scruple to discover to him all the various Incidents of his Life, and the black one in particular.—Which *Lucretia* pretended she had learned from the Gentleman himself, assuring me at the same Time, that the Hermit was yet living, but had moved his Quarters; though I would be curious to know if he has seen since the ominous Handkerchief, for it is ten Years since she told me the Story, and as she has herself paid since the common Tribute to Nature, I despair receiving any further Intelligence on that Head.

The same virtuous Lady had made a Sort of Compact

fact with a poor young Man she had debauched, for she was then too stale and too ugly to be debauched, or rather she had been debauched sooner than she was naturally fit for it, that the first of the two that should die, should come to inform the other of what passes in the other World. The young Man died first, to which she had very much contributed, by obliging him oftner, than he really could, to hornify her Husband; but if he was glad to be rid of her at any Rate; or afraid, if he was to come back, to be trapped once more into his former transitory Hell; I did not hear that he had endeavoured to perform his Promise.

The monstrous Incoherences this Relation is interspersed with, shew plainly the Ridicule of this *Apparition*; for it is against all Sort of Reason, to suppose that the pretended Hermit, would have disclosed a Secret of that Consequence, at the first Sight of a Person he knew nothing of, and could have reasonably suspected to have been sent on Purpose to trap him; could even all his Entreaties have persuaded him to open his Door, which it was in his Power to have kept shut? No; and if by some unforeseen Accident he had been discovered, could he not have instantly changed his Lodgings, as he is represented to have done afterwards? Besides what means that Ceremony of dressing or undressing a Child? Are Children nursed in the other World? If it was to put him in Mind of his Crime, that Precaution was needless; since he is pretended to have retired there with the formed Design of making a Sort of Attonement for that Crime, and for no other; which must make us think that all those *Apparitions* are nothing else but the Fictions of some shattered Brain, like our modern *Lucretia*.

An unfortunate Gentleman of my Acquaintance had a Year ago an *Apparition*, which had some Incidents like this above-mentioned,—Betwixt ten and eleven at Night, he heard a dreadful Thundering at his Door, which he answered by one *who's there*, pronounced in the Tone of a Man, who thinks himself Master on his own Dunghil; his *who's there* was reposted by a Cry of Murther; at which the Gentleman believing that it was some Friends (though the Voices did not sound as if they had been human Voices) who were pursued *Vi & Armis*, and were running to him for Refuge, hastened to open his Door, when to his Surprise, he was assailed with a Volley of Blows, which deprived him at once of all his Senses, except that of Feeling; the first Thought he was capable of was, that Hell was let loose upon him, and therefore bethought of a Conjurat[i]on, but every Time he opened his Mouth, to articulate it, it was immediately stopp'd with an iron close Fist, often pushed down half Way his Throat, as if willing to reach his Soul; which made him conclude at last that it was *Lucifer* himself, or at least some of his Emissaries, confirmed, therein, by the poisonous Smell they had infected the Room with, though he could not very well distinguish if it was of Brimstone, or something else; 'till at last, with much Difficulty, opening his

Eyes, overswelled with the Blows, two amphibious Monsters, half Devil, and half Woman, appeared to him, which he took then for the two Harpies, *Aello* and *Ocyrete*; for in Fact they had Faces like Women, and something like Wings on their Shoulders; their Hands were certainly hooked like the Talons of Birds of Prey, and in all Likelihood their Feet also; their Voice was without doubt the Voice of Harpies, for one could distinguish nothing but a shrill Sound, with now and then the polite Expression of *Dog, Son of a B——ch*, &c. enough to confound a human Understanding.—He has told me since, that he could have wish'd them once more confin'd in the *Ægean* and *Sicilian* Sea, and that he cursed heartily the *Boreades* for having expelled them from thence; unless they could have invested him, at that Instant, with the same Power, to expel them from his Apartment; where they staid 'till after twelve, alarming the whole Neighbourhood.—Some of his kind Neighbours taking them for two *Apparitions* of evil Spirits, or of some damned Souls, were for sending for a Parson to lay them in the *Red Sea*; and others believing them not quite ready for the Place, would have them laid in one of the Compters, but my Friend considering that our Prisons are already an Emblem of Hell, perfect enough without Addition, chose rather to bear the Brunt, than to expose our poor Prisoners to new Torments.

The *French* had imagined, in antient Times, that against the Death of their King, there happened always a very grand *Apparition* in the Forest of *Fontainebleau*, which, the Form it appeared in, with Horses, Dogs, French-Horns, Huntsmen, &c. made them call that *Apparition* the *GRAND VENEUR*, the King's great Huntsman; but if the *Grand Veneur* is so superannuated, as to have been incapable for a very considerable Time to have taken the Fields, or if he has lost his hunting Equipage, we hear at present nothing of him; sure some ill-natured Priest has not metamorphosed the *Grand Veneur* into a Fisherman, and sent him a fishing into the *Red Sea*?

They had also a Notion very much like this in *Brandenbourg*, where they pretended that a few Days before the Death of an Elector, his Predecessor used to appear in some Gallery of the Castle; but lately, if the *Apparitions* are at Variance with us, or if they have found so much Employment, or Occupation in the other World that they do not mind this, they don't visit us so often as they used to do our Ancestors. Perhaps they are more afraid of our Clergy, than they were then, and well they may, for I know one here about *London*, who, when enlivened with some Cups of *Diapente*, or Punch, which is his favourite Liquor, could speak to them *Greek* in *Latin*, which the Learned know is enough to affright any *Apparition* out of his Wits; since it had at first that Effect on the Congregation he is appointed Vicar to; but they are at present so well used to it, that, even, in the greatest Agitations of the Spirit, they mind him no more than when he is sober, which is but seldom.

ARCHITECTURE.

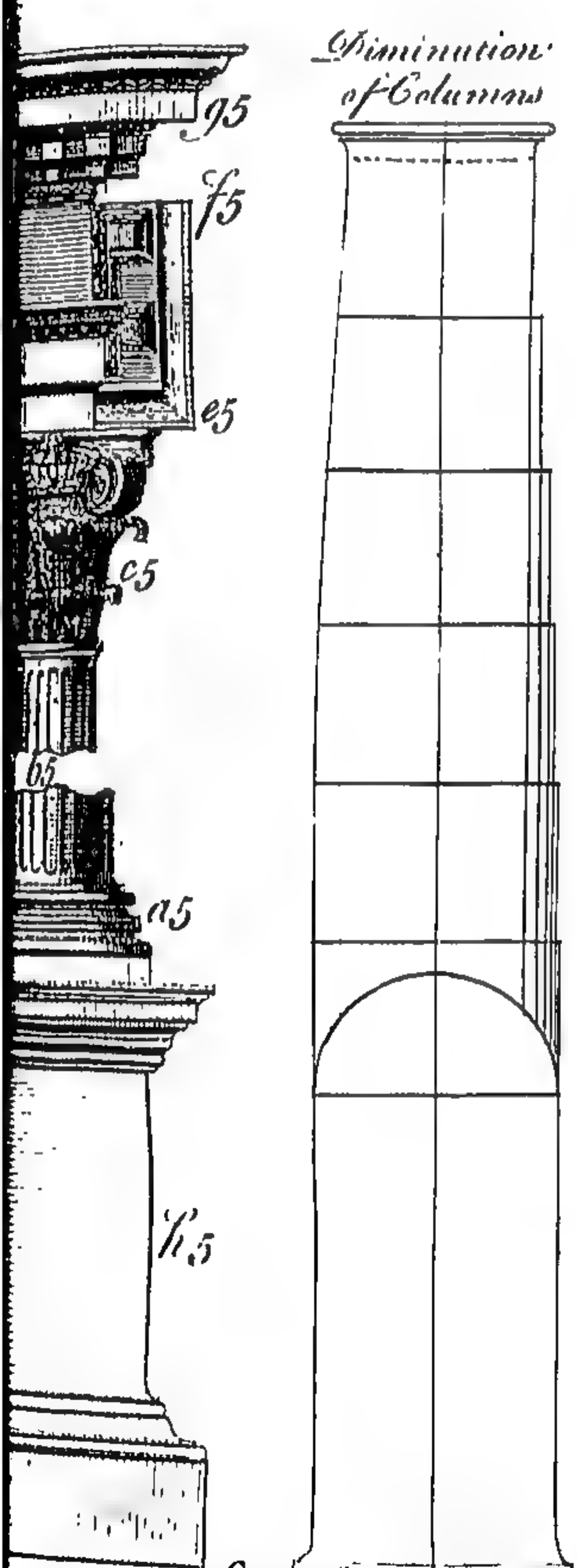
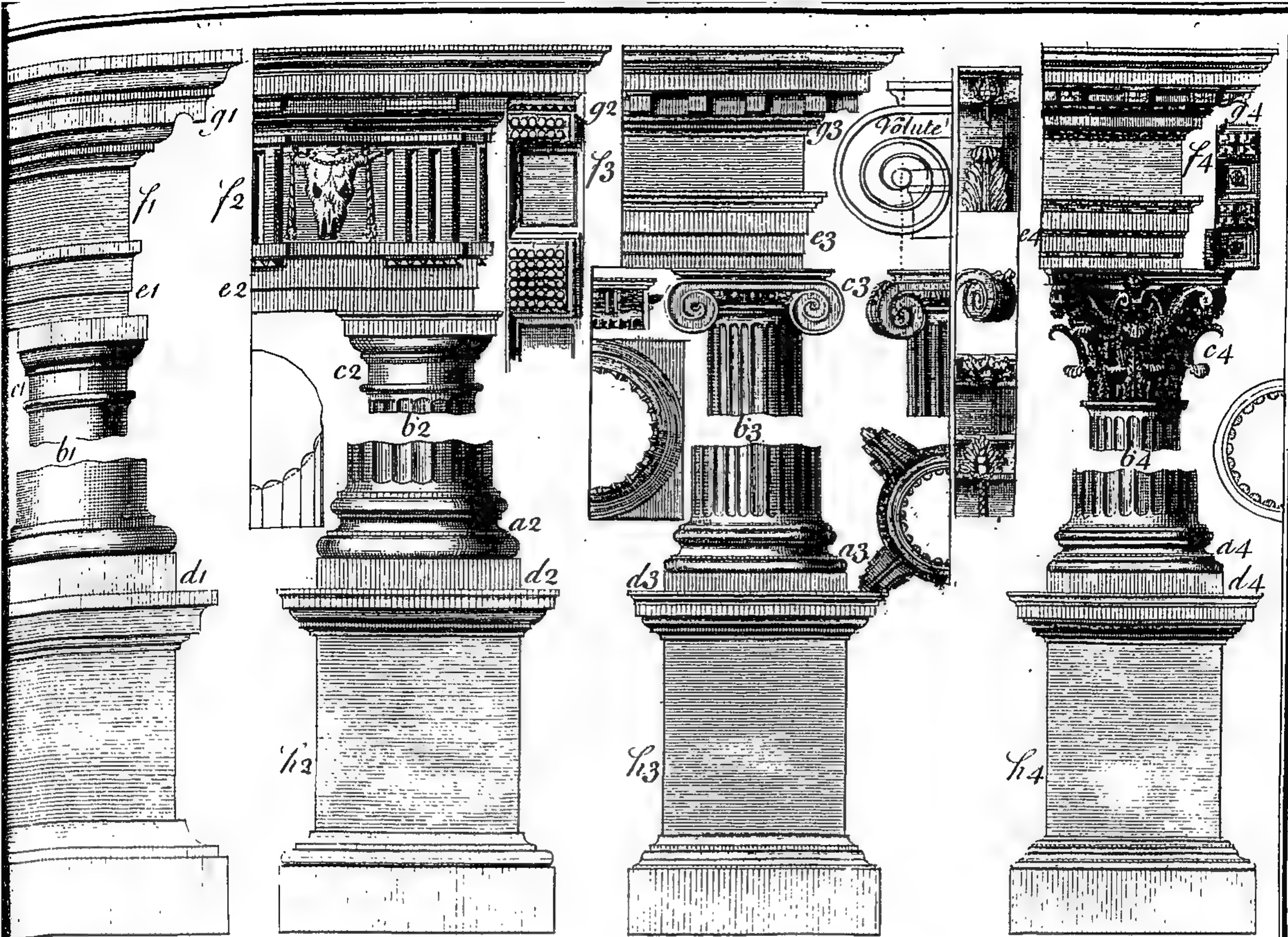
ARCHITECTURE is the Art of erecting Edifices, either for Habitation or Strength. With Respect to its Objects, 'tis divided into three Branches, *Civil*, *Military* and *Naval*.

CIVIL ARCHITECTURE, is the Art of contriving and executing commodious Buildings for the Uses of civil Life, as Houses, Temples, Theatres, Halls, Bridges, Colleges, Portico's, Columns, Obelisks, Pyramids, &c. which Art is to be exemplified, and elucidated in our Treatise of Building under the Letter *B*.

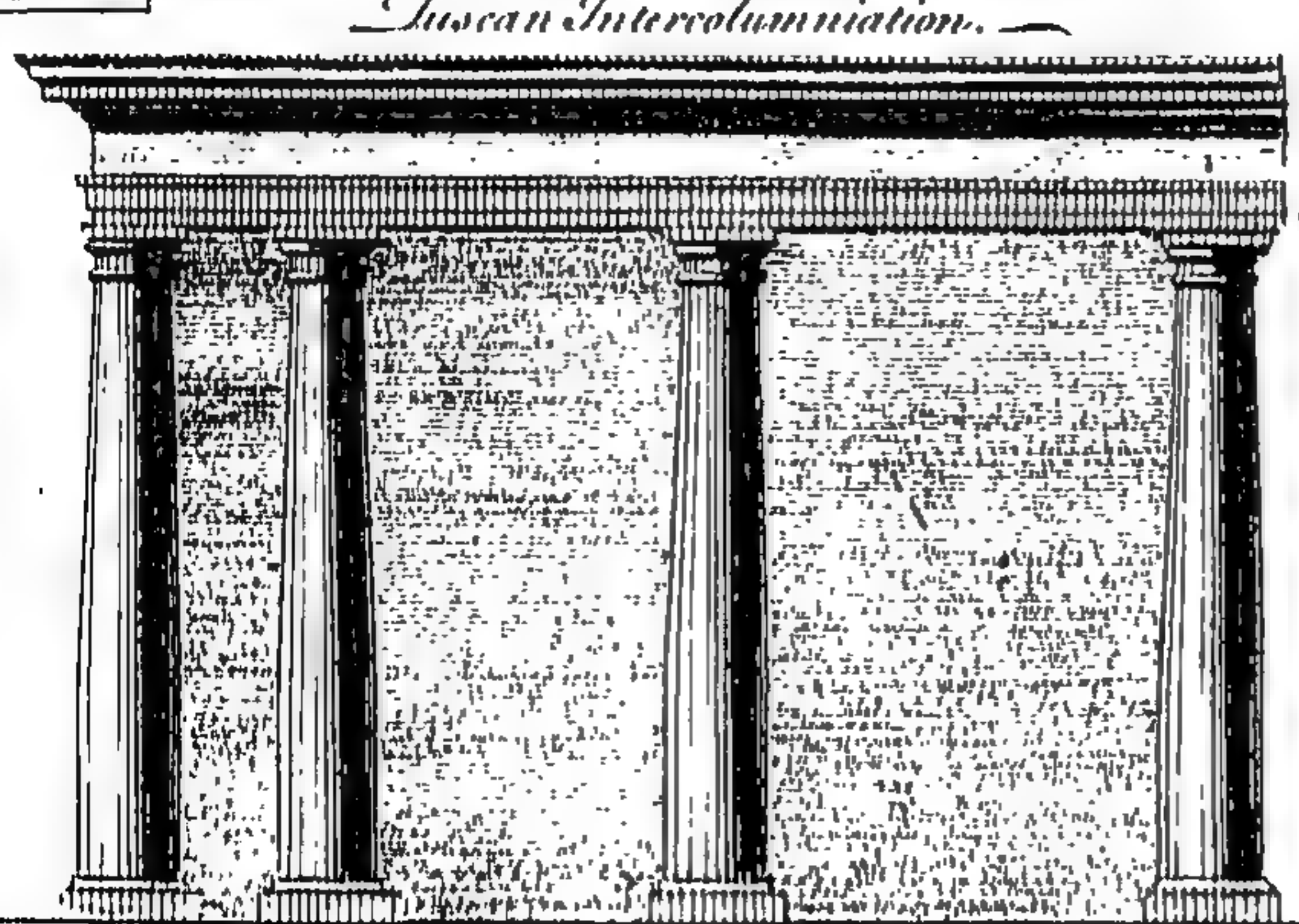
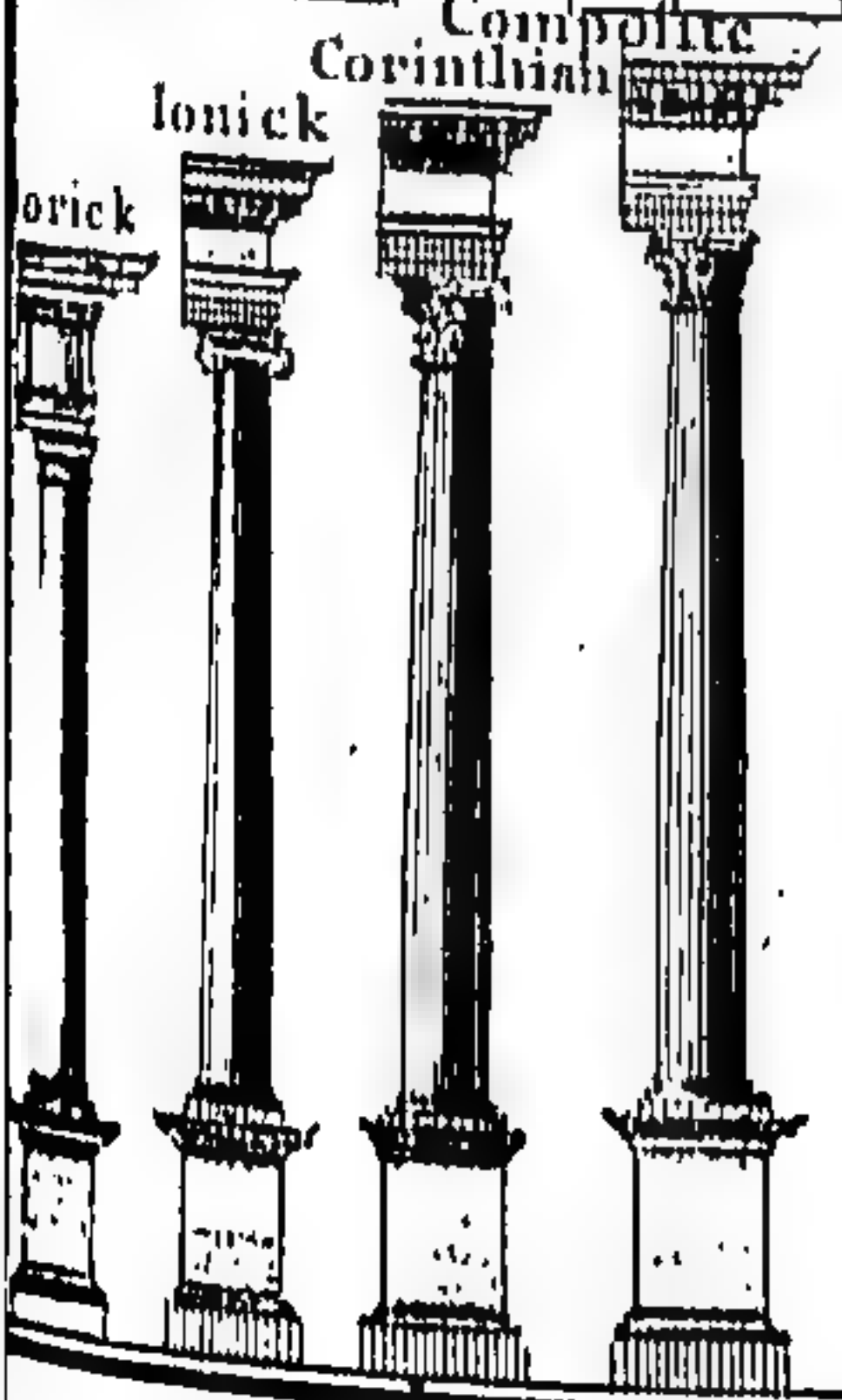
MILITARY ARCHITECTURE, is the Art of Fortifications, *i. e.* of erecting Citadels, of forming Polygons, with Horn-works, Half-moons, Counterscarps, Bastions, Cavaliers, Glacis, &c. of which at large in our Treatise of Fortifications under the Letter *F*.

NAVAL ARCHITECTURE, is the Art of Ship-building, which *Naval Architecture* is to be treated of under the Letter *N*.

In this Place we'll treat only of *Architecture* in general, considered either with Regard to its several Periods or States, (and so divided into *Antique*, *Antient*,



Filler	
Cima recta	
Corona	
Modillions	
Dentels	
Ovolo	
Cima	
Cavette	
Abacus	
Antingal	
Scotia	
Cavetto	
Cavetto Reversa	
Cima Reversa	



tient, *Gothick*, *Modern*, &c. *Architecture*,) or to the five Orders or Manners of Building, *Tuscan*, *Dorick*, *Ionic*, *Corinthian*, and *Composite*.

Antique, differs no otherwise from *Antient Architecture*, but as a *Genus* from its *Species*; — *Antique* is applied to such Pieces of Building, as were made at the Time when the Arts were in their greatest Perfection, amongst the antient *Greeks* and *Romans*, viz. from the Age of *Alexander the Great*, to the Time of the Emperor *Pbocas*, about the Year of Christ 600, when *Italy* became over-run by the *Goths* and *Vandals*. — All Edifices erected from that *Epocha* to the Restauration of *Architecture* to its pristine Splendor, are called antient Edifices, because the Art was not then in its utmost Purity.

The Difference between antique and antient Buildings appears particularly in the joining of the Stones together, in which the antique Architects were so very curious and exact, that it is very difficult to discern the Joints in a great many Places, and which contributed much to the Beauty, Strength and Solidity of the Building.

This, in my Opinion, could not be done, without having those Sides of the Stones squared and wrought first, which were to be laid one above another, leaving the other Side rough, after which they were made use of in the Building; so that the Angles or Edges of the Stones not being so sharp, they could move them up and down better, till they joined well, and were in no more Danger of breaking, than if all the Sides had been squared; for the Angles being then too thin, are apter to break.

In this Manner they made all their Stone Buildings rough and rustick, as it were; and when these were compleated, they continued to polish those Sides of the Stones that were exposed to View. — It must be acknowledged, that as the Roses between the Modillion or other Decorations of the Cornice, could not be commodiously worked after the Stones were fixed, they made them while they lay on the Ground. — This is evident by many antient Buildings, in which several Stones are found that were left unwrought and unpolished. The Arch near the old Castle in *Verona*, and all the other Arches, and antient Edifices in that Place, were made after the same Manner: This we easily discover by the Marks of the Tools, which shew in what Manner the Stones were wrought.

The Columns of *Trojan* and *Antoninus* at *Rome*, were thus wrought; for it would have been impossible, otherwise, to have fixed the Stones, so as that the Joints should meet so close together, cross the Heads, and other Parts of the Figures. — The same may be said of those triumphal Arches that are found there, for when they had any large Edifice to erect, as the Amphitheatre of *Verona*, that of *Pola*, and the like, to save Time and Charge, they only wrought the Imposts of the Arches, the Capitals and Cornices, leaving the rest Rustick, regarding only the Beauty of the whole Fabrick. — But in Temples and other magnificent Edifices, that require great Delicacy, they spared no Labour in working them, but glazed and polished them, even to the very Flutes of the Columns, with the utmost Accuracy and Application.

GOThICK ARCHITECTURE, is that which deviates from the Proportions, Characters, &c. of the *Antique*.

The *Gothick Architecture* is frequently very heavy, solid, and massive; and sometimes, on the contrary, exceedingly light, delicate and rich. — The Abundance of little whimsical, impertinent Ornaments, are its most usual Character.

Authors distinguish two Kinds of *Gothick Architecture*; the one antient, the other modern. — The antient is that which the *Goths* brought with them from the North, in the fifth Century: The Edifices built in this Manner were exceedingly massive, heavy and coarse.

Those of the *modern Gothick* run into the other Extreme, being light, delicate, and rich to a fault;

Witness *Westminster Abbey*, the Cathedral of *Litchfield*, the *Cross* of *Coventry*, &c.

The last Kind continued long in use, especially in *Italy*, viz. from the thirteenth Century to the Restauration of the *Antique Building* in the sixteenth. All the antient Cathedrals are in this Kind.

The Inventors of the *Gothick Architecture* thought, no doubt, they had far surpassed the *Greek Architects*: A *Greek Building*, as I have observed already, has not a single Ornament but what adds a Beauty to the whole. The Parts necessary to sustain or shelter it, as the Columns, Cornices, &c. derive all their Beauty from their Proportions; every Thing is simple, measured and restrained to the Use it is intended for. — No daring out-of-the-way Strokes. — Nothing quaint to impose on the Eye; the Proportions are so just, that nothing appears very grand of itself, tho' the whole be grand. — On the contrary, in the *Gothick Architecture*, we see huge Vaults raised on slender Pillars, which one would expect every Minute to tumble down, though they will stand for many Ages, every thing is crammed with Windows, Roses, Crosses, Figures, &c.

MODERN ARCHITECTURE is that which partakes partly of the *Antique*, retaining somewhat of its Delicacy and Solidity, and partly of the *Gothick*, whence it borrows Members and Ornaments, without Proportion or Judgment; tho' we have learn'd, for several Years past, to lay aside the extravagant Abuses and ridiculous Inventions introduced among us, from a depraved Taste for *Gothick Architecture*; whence we may justly believe, that this Art has been lately so far improved, as to be carried in time to that Pitch of Perfection, which in all Arts is principally sought after. — The *Italians* seem to have made the most considerable Advances towards it, and built a vast Number of sumptuous Edifices, which rival the *Roman Grandeur* and Magnificence.

Before I give an exact Description of the five different Orders of *Architecture*, which all publick and private Edifices must be composed of, it will not be improper to observe here, that the Columns, in each of the five Orders, are to be made so as the Diameter of the upper Part of the Column, may be less than at the Base, and have a little Swelling in the Middle.

In the Diminution of the Columns, we must take Care that the longer they are, the less they must diminish, because the Height, by Reason of the Distance, has the Effect of Diminution.

Vitruvius, l. iii. c. 2. gives us Directions to that purpose; for he says, that if the Column be fifteen Feet high, the Diameter at the Bottom must be divided into six Parts and a Half, and five and a Half must be the Thickness at Top; if from fifteen to twenty Feet, the Diameter at the Bottom must be divided into seven Parts, and six and a Half will be the Diameter at Top. — The same Observation must be made in those that are from twenty to thirty Feet high, where the Diameter, at the Bottom, must be divided into eight Parts, seven of which will be the Diameter at Top; and thus such Columns as are of a greater Height, will diminish in the Manner above-mentioned.

As to the Swelling which is to be in the Middle of the Column, this excellent Author has left us in the Dark; but *Palladio* has supply'd his Defect, and left us a Method for the Profil of such Swelling. — He divides the Fust of the Column into three equal Parts, and leaves the lower Part exactly perpendicular; to the Extremity whereof he applies a thin Rule of the exact Length, or sometimes a little longer than the Column, and bends that Part of the Rule which comes forwards, till the Point thereof touches the Point of Diminution of the upper Part of the Column, under the *Collarino*; then he marks as that Curve directs; thus he has the Column swelling a little in the Middle, and projecting forward, which strikes the Eye very agreeably.

The Diameter must always be taken at the lowest Part:

Part of the Column, and the Intercolumnations, which are the Distances between the Columns, are to be one Diameter and a Half, or of two Diameters, of two and a Quarter, of three, and sometimes more of the Column, tho' the Antients never exceeded three, except in the *Tuscan Order*, where the Architraves being of Timber, they made the Intercolumnations very large. But then they never made them less than a Diameter and a Half, which Distance they particularly observed when the Columns were very lofty.—But they principally approved of those Intercolumnations, which were of two Diameters and a Quarter, and esteemed them as most elegant and beautiful.

The Beauty and Elegance of the Columns are very much heightened by the Proportion and Harmony between them and the Intercolumnations; for if small Columns are made with large Distances, or Intercolumnations, the too great Quantity of Air in the void Spaces will very much lessen their Thickness, and consequently diminish their Beauty; and if, on the contrary, there are but small Intercolumnations, between large Columns, the too little Vacuity will make them appear heavy, thick, and disagreeable. Therefore, if the Distance be more than three Diameters, the Thickness of the Column must be a seventh Part of its Height, as I shall observe hereafter in the *Tuscan Order*.—But if the Distances are three Diameters, then the Length of the Column must be seven Diameters and a half, or eight, as they are in the *Dorick Order*.—If two and a quarter, the Columns must be nine Diameters and a half in Length, as in the *Corinthian*.—And if a Diameter and a half only, the Length of the Columns must be then ten, as in the *Composite*.

In the Front of any Edifice the Columns must be of an even Number, that there may be an Opening in the Middle, larger than the other Distances and Intercolumnations, for the Doors and Entries; that is to say, for single Pillars and Columns.—But if Galleries are to be made with Pilasters, they must be disposed so that the Thickness of Pilasters or Piers be not less than the third of the Void from Pier to Pier, and to those in the Angles two Thirds, which will make the Angle in the Building more solid and substantial.—When these Piers are to support a cumbrous Load, as in large Structures, then they must have half the Thickness of the Vacancy, or otherwise two Thirds in publick Edifices; but in private ones they must be as thick, at least, as the third Part of the Opening, but no thicker than two Thirds, and ought to be square.—But to save Charges, and make it more commodious, and the Passage more open, they need not be so thick in Flank as in Front; and for its Embellishment, half Columns or Pilasters may be placed in the Middle, to support the Cornices over the Arches of the Gallery, whose Thickness must be in Proportion to their Height, according to each Order, as I shall demonstrate in the Course of this Treatise.

For the Division and Mensuration of the above-mentioned Orders, we'll make use of the same Measure or *Module*, which *Vitruvius* used to divide the *Dorick Order* with, which *Module* is taken from the Diameter of the Column, and which may be used in all the Orders.

This *Module* is the Diameter of the Column at Bottom, and is divided into sixty Minutes, except in the *Dorick*, in which the *Module* is half the Diameter of the Column, and is divided into thirty Minutes, this being more commodious in the Divisions of that Order.—One may therefore divide the *Module* into more or less Parts, according to the Quality of the Edifice, and use the Designs of the Proportions and Profils suitable to each Order.

These general Rules would suffice to Persons, who have some Tincture of *Architecture*, and I could now proceed to the Demonstration of the five Orders, if my Work was calculated for them only; but as I have promised it should serve for a general Instruction, and

hope it will be read equally by those who have not the least Notion of the Arts and Sciences I am to treat of, as by Masters or Proficients in those Arts and Sciences, I must give in this Place a clear Explanation of these Terms, Columns, Intercolumnation, Diameter of a Column, and of a Module.

A COLUMN in *Architecture*, is a round Pillar made to support or adorn a Building.

The entire *Column* in each Order is composed of three principal Parts, the *Base*, the *Shaft*, and the *Capital*.

(A) The *BASE* of a *Column* is that Part between the Shaft and the Pedestal, if there be any Pedestal; or if there be none, between the Shaft and the Plinth, or Socle.

The *Base* is supposed to be the Foot of the *Column*, or as some will have it, it is that to a *Column* which a Shoe is to a Man.

The *Base* is different in the different Orders, as we shall see, when we come to treat of those Orders.

(B) The *SHAFT* of a *Column* is the Body thereof; thus called from its Streightness; tho' most commonly called the *Fust*.

(C) The *CAPITAL* is the uppermost Part of a *Column*, serving as the Head or Crowning thereof, placed immediately over the *Shaft* or *Fust*, and under the *Entablature*.—The *Capital* is a principal and essential Part of a *Column*, is made different in the different Orders, and is that which chiefly distinguishes the Orders themselves.

Each of these Parts is again subdivided into a great Number of lesser, called *Members* or *Mouldings*, some whereof are essential, and found in all *Columns*; others are only accidental, and found in particular Orders.

MEMBERS or MOULDINGS are Jettings or Projections beyond the naked Part of a *Column*, of a Wall, Wainscot, &c. the Assemblage whereof forms Cornices, Door-Cases, and other Decorations of *Architecture*.

Some *Mouldings* are square, others round, some strait, others carved, &c.—Some are plain, others carved, or adorn'd with Sculpture, either hollowed, or in *relievo*.

Some *Mouldings*, again, are crowned with a *Fillet*, others are without, as the *Doucine*, *Talon*, *Ovolo*, *Torus*, *Plinth*, *Scotia*, *Astragal*, *Gula*, *Corona*, and *Cavetto*.

FILLET, in *Architecture*, is a little square Member or Ornament, used in divers Places, and on divers Occasions; but generally as a Sort of *Corona*, over a greater Moulding; and on Occasion, serves to separate the *Flutings* of *Columns*.

The *Fillet* is the same with what the *Italians* call *Lista*, or *Listella*; and the *French*, *Bande*, *Bandelette*, and *Reglet*; though the *Reglet*, according to *Daviler*, differs from the *Fillet*, in that it projects equally like a Ruler.

The *DOUCINE* is a *Moulding* on the highest Part of the Cornice, in form of a Wave half Convex and half Concave.—The *Doucine* is the same with a *Cymatium* or *Gula*.

Vitruvius does not confine *Cymatium* to the Cornice, but uses it indifferently for any similar Moulding, wherever he meets with it; in which he differs from the most accurate among the Moderns.

Felicien makes two Kinds of *Cymatiums*; the one right, and the other inverted; in the first, that Part which projects the furthest is concave; and is otherwise called *Gula recta*, and *Doucine*.—In the other, that Part that projects farthest is convex, called *Gula inversa* or *Talon*.

Our *Architects* do not use to give the Name *Cymatium* to these Mouldings, except when found on the Tops of Cornices; but the Workmen apply the Name indifferently, wherever they find them.—*Palladio* distinguishes the *Cymatium* of the Cornice, by the Name *Intavolata*.

TALON (a *French* Word which literally signifies *Heel*) is a *Moulding* concave at the Bottom, and convex

vex at the Top; having an Effect just opposite to the *Doucine*.—When the concave Part is a-top, it is called an *inverted Talon*.

The *Talon* is usually called by our *English* Workmen *Ogee*, or *O. G.* and by Authors an *upright*, or *inverted Cymatium*.—The Figure of the *Ogee* bears some Resemblance to that of an *S*.

The *Ovolo* is a round Moulding, whose Profile or Sweep in the *Ionick* and *Composite* Capitals, is usually a Quadrant of a Circle; whence it is also popularly called the *Quarter Round*.—It is usually enrich'd with Sculptures among the *Antients* in form of Chesnut Shells; whence *Vitruvius*, and other of the *Antients*, call it *Echinus*, Chesnut-shell.—Among us it is usually cut with the Representation of Eggs, and Anchors, or Arrows-heads, placed alternately; whence its *Italian* Name *Ovolo*, *Latin* *Ovum*, and *French* *Oeuf*, q. d. *Egg*.

(D) *PLINTH* is a flat square Member in form of a Brick; sometimes also called the *Slipper*.—The *Plinth* is used at the Foot or Foundation of *Columns*; being that flat square Table under the Mouldings of the *Base* and *Pedestal*, at the Bottom of the whole *Order*; seeming to have been originally intended to keep the Bottom of the primitive wooden Pillars from Rotting.—The *Plinth* is also called *Orle* or *Orlo*.—*Vitruvius* also calls the *Tuscan Abacus*, *Plinth*, from its resembling a square Brick.

The *TORUS*, or *TORRE*, is a large round Moulding used in the Bases of *Columns*.—The *Tore* is also called *Gros Baton*, and *Tondin*.—It is the Bigness that distinguishes the *Tore* from the *Astragal*.—The Bases of the *Tuscan* and *Dorick* *Order* have but one *Tore*, which is between the *Plinth* and the *Listel*.—In the *Attick Base* there are two; the upper, which is the smaller; and an under, or bigger.

SCOTIA is a Semicircular Cavity or Channel between the *Tores*, in the Bases of *Columns*.—It is a concave dark Moulding; whence its Name, viz. from *scotus*, Obscurity, Darkness.—The *Scotia* has an Effect just opposite to that of the *Quarter-round*.—Our Workmen frequently call it the *Casement*.—It is also called *Trochilus*, partly from its Form.—In the *Ionick* and *Corinthian* *Base*, there are two *Scotia's*, the upper whereof is the smaller.—According to *Felibien*, the *Cavetto* is a fourth Part of the *Scotia*.

The *ASTRAGAL*, in *Architecture*, is a little round Member, in form of a Ring, or Bracelet; serving as an Ornament at the Tops and Bottoms of *Columns*.—The *Astragal* is sometimes also used to separate the *Fascia* of the *Architrave*; in which Case it is carved Chaplet-wise, with Beads and Berries.—It is also used both above and below the *Listel*, adjoining immediately to the Square or Dye of the *Pedestal*.

The *GULA*, *GUEULE*, or *GOLA*, in *Architecture*, is a Wave Member, whose Contours resemble the Letter *S*.—This Member is of two Kinds, *Recta* and *Inversa*.—The first and principal has its Cavity above, and convexity below. This always makes the Top of the *Corona* of the Cornice, jetting over the Drip of the Cornice like a Wave ready to fall.—It is called *Gula Recta*, by the *French*, *Doucine*.—The second is just the Reverse of the former, its Cavity being at the Bottom; so that it appears inverted, with Regard to the former.—This is used in the *Architrave*, and sometimes in the Cornice, along with the former, only separated by a *Reglet*.

Some derive the Word from the Resemblance these Members bear to the *Gula*, or Throat of a Man: Others from the Herald's Terms, *Gules*; as supposing the Moulding form'd from the ancient Manner of wearing their Garments, which consisted of Slips of Swaths, alternately Fur and Stuff of various Colours; the Intervals between which were called *Gules*, or *Guaules*.

The *CORONA*, *Crown*, or *Crowning*, is a large, flat, massive Member of the Cornice; so called be-

cause it crowns not only the Cornice, but the *Entablature*, and the whole *Order*.—The *French* call it *Larmier*, our Workmen the *Drip*, as serving by its great Projecture, to screen the rest of the Building from the Rain.—Some *Latin* Authors call it *Supercilium*; and, as it should seem, by Mistake *Stillicidium*.—Certain *French* Authors call it *Mouchette*; and certain *Latin* ones *Mentum*, Chin; from its keeping the Weather from the Parts underneath, as the Chin does the Sweat, &c. out of the Neck.

Some call it absolutely the *Cornice*, as being the principal Member thereof.—*Vitruvius* frequently uses the Word *Corona* for the whole *Cornice*.—The *Corona* is itself crown'd or finish'd with a *Reglet* or *Fillet*.—There are sometimes two *Corona's* in a *Cornice*, as in the *Corinthian* of the *Rotunda*.

The *CAVETTO* is a hollow Member or Moulding, containing a Quadrant of a Circle, and having an Effect just contrary to that of a *Quarter-round*: It is used as an Ornament in *Cornices*.—Mr. *Felibien* observes, that the Workmen confound the *Cavetto* with a *Scotia*, but to ill purpose; the *Cavetto* being, in effect, only half a *Scotia*; yet he himself is chargeable with the same Oversight.—When in its natural Situation, the Workmen frequently call it *Gula* or *Gucula*; and when inverted *Gorge*; which *Gorge*, is a Sort of concave Moulding, concave in the upper Part, and convex at Bottom, more properly called *Gula* and *Cymatium*.

The *ABACUS* is the uppermost Member of a *Capital* of a *Column*, serving as a Kind of Crowning, both to the *Capital*, and the whole *Column*.

Vitruvius, and others after him, who give the History of the *Orders* tell us, the *Abacus* was originally intended to represent a square Tile laid over an *Urn*, or over a Basket. An *Albanian* Woman happening to place a Basket thus covered, over the Root of an *Acanthus*; that Plant shooting up the following Spring, encompassed the Basket all around, till meeting with the Tile, it curled back into a Kind of Scrolls. An ingenious Sculptor passing by, took the Hint, and immediately executed a *Capital* on this Plan; representing the Brick by the *Abacus*, the Leaves by the *Volutes*, and the Basket by the *Vasa*, or Body of the *Capital*. Such was the Rise of the first regular *Order*.

There is some Difference in the Form of an *Abacus* in different *Orders*. In the *Tuscan*, *Dorick*, and ancient *Ionick*, it is a flat square Member, well enough representing its original Tile, whence the *French* call it *Tailloir*, Trencher. In the richer *Orders* it loses its native Form; its four Sides or Faces being arched or cut inwards, with some Ornament, as a Rose or other Flower, or Fish's Tail, in the Middle of each Arch. But some *Architects* take other Liberties in the *Abacus*, both in Respect of its Name, Place and Office. Thus in the *Tuscan* *Order*, where it is the larger, and more massive, as taking up one third of the Height of the whole *Capital*, it is sometimes called the *Dye* of the *Capital*. In the *Dorick*, it is not always the uppermost Member of the *Capital*; a *Cymatium* being frequently placed over it. In the *Ionick*, some make it a perfect *Ogee*, and crown it with a *Fillet*.

The Proportion of the *Abacus*, as prescribed by *Vitruvius* (4. 1) is short, is diagonal (from Corner to Corner) being twice its Height, a Rule which the Moderns makes no Difficulty of dispensing withal.

VOLUTE is a Kind of spiral Scroll, used in the *Ionick* and *Composite* *Capitals*, whereof it makes the principal Characteristick and Ornament. Some call it the *Ram's Horn*, from its Figure, which bears a near Resemblance thereto. Most *Architects* suppose that the *Antients* intended the *Volute* to represent the Bark or Rind of a Tree, laid under the *Abacus*, and twisted thus at each Extreme where it is at Liberty; others will have it a Sort of Pillow or Bolster, laid between the *Abacus* and *Echinus*, to prevent the latter being broke by the Weight of the former, and the *Entablature* over it, and accordingly call it

Pulvinus. Others after *Vitruvius*, will have it to represent the Curls or Tresses of a Woman's Hair. The Number of *Volutes* in the *Ionick Order*, is four; in the *Composite*, Eight. There are also eight angular *Volutes* in the *Corinthian Capital*, accompanied with eight other small ones, called *Helices*.

The *ACHANTUS* is only an Ornament in the *Corinthian* and *Composite Orders*; being the Representation of the Leaves of an *Achantus Plant*, in *English*, *Bear's-foot*, in the Capital thereof.

Over the *Capital* is the *ENTABLATURE*; comprehending the *Architrave*, *Freeze*, and *Cornice*. The *Entablature* is also called the *Trabeation*; and by *Vitruvius* and *Vignola*, Ornament: It is different in the different Orders: Indeed it consists of the three grand Parts or Divisions above-mentioned in all; but those Parts consist of a greater or less Number of particular Members or Sub-divisions, as the Orders are more or less rich.—*Vignola* makes the *Entablature* a quarter of the Height of the whole Column, in all the Orders. In the *Tuscan* and *Dorick*, the *Architrave*, *Freeze*, and *Cornice*, are all of the same Height. In the *Ionick*, *Corinthian*, and *Composite*, the whole *Entablature* being fifteen Parts; five of them are allowed for the *Architrave*, four for the *Freeze*, and six for the *Cornice*.

(E) The *ARCHITRAVE* is that Part of a Column which lies immediately upon the *Capital*.—The *Greeks* call it *Epistyle*.—The *Architrave* is the lowest Member of the *Entablature*.—The *Architrave* is supposed to represent the principal Beam in Timber Buildings; whence the Name which is formed of the *Greek*, ἀρχή, Chief, and the *Latin*, *Trabs*, Beam.—The *Architrave* is different, in different Orders.—In the *Tuscan*, it only consists of a plain Face, crowned with a *Fillet*; and is half a *Module* in Height.—In the *Dorick* and *Composite*, it has two Faces, or *Fasces*; and three in the *Ionick* and *Composite*; in which last Order, it is $\frac{1}{2}$ of a *Module* high.—*Architects* however, take a deal of Latitude in this Part; some using more Members than others; and many of them having two or three Forms of *Architraves*.—*Architrave* is sometimes also called the *Reason-piece* or *Master-beam*, in Timber Buildings, as *Portico's*, *Cloisters*, &c.—In Chimneys it is called the *Mantle-piece*; and over the Jaumbs of Doors or Lintels of Windows, *Hyperthyron*.

(F) The *FREEZE* or *FRIZE*, is that Part of the *Entablature* of Columns, between the *Architrave* and *Cornice*; and is properly a large flat Face or Member, separating the *Architrave* from the *Cornice*.—The *Antients* called it *Zophoros*, Ζωφόρος, by Reason it was usually enriched with Figures of Animals; and our Denomination *Freeze*, has a like Origin, being formed of the *Latin*, *Phrygio*, an Embroiderer, because it is commonly adorned with Sculptures in *Basso Relievo*, imitating Embroidery.

The *Freeze* is supposed to be intended to represent the Heads of the transverse Beams, that sustain the Roof or Covering.—In the *Tuscan Order* it is quite plain. In the *Dorick*, enriched with *Tryglyphs*. In the *Ionick*, it is sometimes made arched or swelling, in which Case it is called by *Vitruvius*, *pulvinatus*, q. d. bolstered. In the *Corinthian* and *Composite*, it is frequently joined to the *Architrave* by a little Sweep; and sometime to the *Cornice*. And in these richer Orders, it is usually adorned with Sculptures, Figures, Compartments, Histories, Foliages, Festoons, &c.

As to the Height of the *Freeze* it is, in general, much the same with that of the *Architrave*.—The *Tuscan Freeze*, *Vitruvius* makes 30 Minutes; *Vignola* 35; *Palladio*, who makes it swelling, gives it but 20; and *Scamozzi* 42. The *Doric*, in *Vitruvius* and *Vignola*, is 30 or 40 Minutes; in *Palladio*, &c. 45. The *Ionick*, *Vitruvius* makes flat, adorned with *Achantus*, Leaves, Lions, &c. and makes it 30 Minutes high; *Vignola*, who also makes it flat, gives it 45 Minutes; and *Palladio*, who makes it convex or swelling, 27 Minutes; and *Scamozzi*, 28. The *Corinthian*, *Vitruvius* enriches with *Achantus* Leaves,

human Figures, &c. and makes its Height 37 Minutes; *Vignola*, 45; *Palladio*, 28; and *Scamozzi*, 35 $\frac{1}{2}$. Lastly, The *Composite*, which in *Vitruvius* is set with Cartoozes, and carved between them, is 34 $\frac{1}{2}$ Minutes; *Vignola*, who makes it like *Vitruvius*, only gives it 45 Minutes; *Palladio*, who makes it swelling, only 30; and *Scamozzi*, 32.

From the Variety of the Enrichments of the *Freeze*, they become variously denominated, as,

Convex or *pulvinated FREEZES*, are those whose *Profil* is a Curve, the best Proportion whereof is when drawn on the Base of an equilateral Triangle.—In some, the Swelling is only a Top, as in a Console. In others at Bottom, as in a Balluster.

Flourished Freezes, are those enriched with Rinds of imaginary Foliages; as the *Corinthian Freeze* of the Frontispiece of *Nero*; or with natural Leaves, either in Clusters or Garlands; or continued, as in the *Ionick* of the Gallery of *Apollo* in the *Louvre*.

Historical Freezes are those adorned with *Basso Relievo's* representing Histories, Sacrifices, &c. as that of the Arch of *Titus* at *Rome*.—*Marine Freezes*, are those representing Sea-horses, Tritons, and other Attributes of the Sea; or Shells, Baths, Grotto's, &c.—*Rustick Freezes*, are those whose Courses are rutticated or imbossed; as the *Tuscan Freeze* of *Palladio*.—*Symbolical Freezes* are those adorned with the Attributes of Religion; as the *Corinthian* of the Temple, behind the Capitol at *Rome*, whereon are represented the Instruments and Apparatus of Sacrifice.

The uppermost Member of the *Entablature* of a Column, or that which crowns and finishes the Order, is called *CORNICHE* (g) or *CORNICE*, from the *Latin*, *Coronis*, a Crowning. The *Cornice* is the third grand Division of the *Trabeation*, commencing from the *Freeze*, and ending with the *Cymatium*.

The *Cornice* is different in the different Orders: In the *Tuscan Order*, it is most plain.—*Vignola* makes it consist of an *Ovum*, or Quarter-round; an *Astragal*, a *Fillet*, a *Larmier*, and a *Talon*. In the *Dorick*, he uses Capitals to the *Tryglyphs* of the *Freeze*, with their *Bandelettes*, a *Talon*, *Mutules* or *Dentils*, a *Larmier*, with its *Gutæ* underneath, a *Talon*, *Fillet*, *Cavetto*, and *Reglet*. In the *Ionick*, the Members are in most Respects the same, as in the *Dorick*, except that they are frequently enriched with Carving, and there are always *Dentils*. In the *Composite*, there are *Dentils*; its Mouldings are carved, and there are Channels under the Soffit. The *Corinthian Cornice* is the richest; and is distinguished by having both *Modillions* and *Dentils*; contrary to the Opinion of *Vitruvius*, who looks on those two Onaments as incompatible; and of Mr. *Le Clerc*, who regards the *Dentils*, as peculiar to the *Ionick*.

For the Heights and Projectures of the Cornices in the several Orders, *Goldman* makes the Height of the *Tuscan* 1 $\frac{1}{2}$, its Projecture 2 $\frac{1}{2}$ Modules: The Height of the *Dorick* 1 $\frac{1}{4}$, its Projecture 2 $\frac{1}{4}$; Height of the *Ionick* 1 $\frac{1}{2}$, its Projecture 2 $\frac{1}{2}$; Height of the *Composite* 1 $\frac{1}{2}$, Projecture 2 $\frac{1}{2}$; Height of the *Corinthian* 1 $\frac{1}{2}$, Projecture 2 $\frac{1}{2}$.

There are different Sorts of Cornices; viz. *Architrave Cornice*, which is that immediately contiguous to the *Architrave*, the *Freeze* being retrenched. *Mutilated Cornices*, whose Projecture is omitted, or else interrupted, Right to the *Larmier*, or reduced into a *Plat-band* with a *Cymatium*. *Cantativer Cornice*, a Term used by the Workmen for a *Cornice* that has *Cantatives* underneath it. *Modillion Cornice*, a *Cornice* with *Modillions* under it. *Coving Cornice*, a *Cornice* which has a great Caisement or Hollow in it; ordinarily lathed, and plastered upon Compass, Sprockets, or Brackets. *Cornice* is also used in general, for any little Projecture, either of Masonry or Joinery, even where there are no Columns. Thus we say the *Cornice* of a Chimney, a Beaufet, &c.

Cornice, is also applied to the Crowning of *Pedestals*. This *Cornice* is different in the different Orders: In the *Tuscan*, according to Mr. *Perrault*, it has a *Platband* which serves as a *Corona*, and a *Cymatium*.

vello, with its Fillet. In the *Dorick*, it has a *Cavetto* with a Fillet, which bears a Drip, crowned with a Square. In the *Ionick*, a *Cavetto* with its Fillet above, and a Drip or pendent Square, crowned with an *Ogee* and its Fillet. In the *Corinthian*, an *Ogee* with its Fillet, a *Cymatium* under the *Corona*, which it hollows to make a Drip, a *Corona*, and an *Ogee* with its Fillet. Lastly, In the *Composite*, a Fillet with a Sweep over the Dye, and *Astragal*, *Cyma* with its Fillet, *Corona*, and *Ogee* with its Fillet.

We have so often mentioned *FASCIA*'s or *FASCIÆ*, that it is not improper to observe here, that *Facia*, in *Architecture*, is a broad Lift, Fillet, or Band; particularly used in *Architraves* and *Pedestals*.

The *Architrave* consists of three *Fasciæ* or Bands; thus called by *Vitruvius*, as resembling Swaths, called in *Latin*, *Fasciæ*.—That Author admits no *Fasciæ* in the *Tuscan Order*, and *Dorick Architrave*, i. e. he makes all plain, without any Division, or cantoning into Parts or *Fasciæ*; but the modern *Architects* take Liberty to differ from him herein. In Brick Buildings, the Juttings out of the Bricks, beyond the Windows in the several Stories, except the highest, are called *Fascia's* or *Fasciæ*.—These are sometimes plain and sometimes moulded; but the Moulding is only a *Cyma Reversa*, or an O. G. at the Bottom, with two plain Courses of Bricks over it, then an *Astragal*, and lastly a *Boulvine*; which *Boulvine*, or *Bollet*, is the Workmens Term for a convex moulding, whose Periphery is just $\frac{1}{4}$ of a Circle; placed next below the *Plinth*, in the *Tuscan* and *Dorick CAPITAL*.

Thus we have carried the *Column*, to its uppermost Extremity, and crowned the whole Order; but we have left it without a *Pedestal*, which is the lowest Part of an Order of *Columns*; being that which sustains the *Column*, and serves it as a Foot, or Stand.

(H) The *PEDESTAL* (from the *Latin*, *Pes*, *pedis*, Foot, and $\pi\upsilon\lambda\alpha\varsigma$, Column) consists of three principal Parts; viz. a square Trunk or Dye, which makes the Body; a *Cornice* the Head; and a Base the Foot of the *Pedestal*.—The *Pedestal* is properly an Appendage to a *Column*, not an essential Part thereof; though Mr. *Le Clerc* thinks it is essential to a complete Order.

The Proportions and Ornaments of the *Pedestal* are different in the different Orders: *Vignola*, indeed, and most of the Moderns, makes the *Pedestal*, and its Ornaments in all the Orders, one Third of the Height of the *Column*, including the *Base* and *Capital*: But some deviate from this Rule. Mr. *Perrault* makes the Proportions of the three constituent Parts of *Pedestals*, the same in all the Orders, viz. the Base one Fourth of the *Pedestal*; the *Cornice*, an eighth Part; and the *Socle* or *Plinth* of the Base two Thirds of the Base itself. The Height of the Dye is what remains of the whole Heights of the *Pedestal*.

(h 1) *Tuscan PEDESTAL*, is the simplest, and the lowest. *Palladio* and *Scamozzi*, make it three Modules high; *Vignola* 5. Its Member, in *Vignola*, is only a *Plinth* for a Base, the Dye and a *Talon* crowned, for a *Cornice*. It has rarely any Base. *Dorick Pedestal*, (h 2) *Palladio* makes four Modules, five Minutes high; *Vignola* five Modules four Minutes. In the Antique, we not only do not meet with any *Pedestals*; but even not with any Base in the *Dorick Order*. The Members in *Vignola's Dorick Pedestal*, are the same with those in the *Tuscan*, with the Addition of a *Mouchette* in its *Cornice*. (h 3) *Ionick PEDESTAL* in *Vignola* and *Serlio*, is six Modules high; in *Scamozzi*, five; in the Temple of *Fortuna virilis*, it is seven Modules, twelve Minutes. Its Members and Ornaments are mostly the same with those of the *Dorick*, only a little richer. The *Pedestal* now usually followed, is that of *Vitruvius*; though we do not find it in any Work of the Antique. Some in lieu hereof use the *Attick Base*, in Imitation of the Antique.

The *Corinthian PEDESTAL* (h 4) is the richest and most delicate. In *Vignola*, it is seven Modules

high; in *Palladio*, five Modules one Minute; in *Serlio*, six Modules, fifteen Minutes; in the *Coliseum*, four Modules, two Minutes. Its Members, in *Vignola*, are as follows: In the Base, are a *Plinth* for a *Socle*, over that a *Tore* carved; then a *Reglet*, *Gula* inverted and enriched, and an *Astragal*. In the Dye are a *Reglet*, with a *Conge* over it, and near the *Cornice* a *Reglet* with a *Conge* underneath. In the *Cornice* is an *Astragal*, a *Freeze*, *Fillet*, *Astragal*, *Gorge*, *Talon*, and a *Fillet*.

In *Vignola* the *Composite PEDESTAL* is of the same Height with the *Corinthian*, viz. seven Modules; in *Scamozzi*, six Modules, two Minutes; in *Palladio*, six Modules, seven Minutes; in the Goldsmiths Arch, seven Modules, eight Minutes. Its Members, in *Vignola*, are the same with those of the *Corinthian*; with this Difference, that whereas these are most of them enriched with Crownings in the *Corinthian*, they are all plain in the *Composite*. Nor must it be omitted, that there is a Difference in the Profiles of the Base and *Cornice* in the two Orders. *Daviler* observes, that the Generality of *Architects* use Tables or Pannels, either in *Relievo*, or *Creux*, in the Dyes of *Pedestals*; without any Regard to the Character of the Order. He observes farther, that those in *Relievo*, only fit the *Tuscan* and *Dorick*; the three others must be indented; which, he adds, is a Thing the Antients never practised, as being contrary to the Rules of Solidity and Strength.

There are besides, square, double, and continued *Pedestals*. *Square Pedestal*, is that whose Height and Width are equal. As that of the Arch of the *Lions* at *Verona*, of the *Corinthian Order*; and such, some Followers of *Vitruvius*, as *Serlio*, *Philander*, &c. have given to the *Tuscan Order*. *Double Pedestal*, is that which supports two Columns, and is more in Width than Height. *Continued Pedestal*, is that which supports a Row of Columns, without any Break or Interruption; such is that which sustains the fluted *Ionick Columns* of the *Tuilleries*, on the Side of the Garden.

The DYE, is the Trunk of the *Pedestal*, or that Part between the *Base* and the *Cornice*; being so called, because it is frequently made in the Form of a *Cube*.

The *Architects* regulate the Proportions of *Columns*, and the Symmetry or Distribution of the whole Building, with a certain Measure called *MODULE*, and usually chuse the Diameter or Semi-diameter of the Bottom of the *Column* for their *Module*; and this they subdivide into Parts or Minutes, a Minute denoting the sixtieth, sometimes only the thirtieth Part or Division of a *Module*.

Vignola divides his *Module*, which is a Semi-diameter, into twelve Parts, in the *Tuscan* and *Dorick*; and into eighteen for the other Orders. The *Module* of *Palladio*, *Scamozzi*, *M. Cambray*, *Des Godetz*, *Le Clerc*, &c. which is also the Semi-diameter, is divided into thirty Parts or Minutes, in all the Orders.

There are two Ways of determining the Measures or Proportions of Buildings; the first by a fixed standard Measure, which is usually the Diameter of the lower Part of the *Column*, called a *Module*, subdivided into 60 Parts called *Minutes*.—In the second there are no Minutes, nor any certain and stated Division of the *Module*; but it is divided occasionally into as many Parts as are judged necessary.—Thus the Height of the *Attick Base*, which is half the *Module*, is divided, either into three, to have the Height of the *Plinth*; or into four, for that of the greater *Torus*; or into six for that of the lesser.—Both these Manners have been practised by the ancient as well as the modern Architects; but the second, which was that chiefly used among the Antients, is in Mr. *Perrault's* Opinion preferable to all others.

As *Vitruvius*, in the *Dorick Order*, has lessened his *Module*, which in the other Orders, is the Diameter of the lower Part of the *Column*; and has reduced that *Module* to a mean one, which is a *Semi-Diameter*;

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M. Perault reduces the *Module* to a third Part for the same Reason, viz. to determine the several Measures without a Fraction.—For in the *Dorick Order*, besides that the Height of the Base, as in the other Orders, is determined by one of these mean *Modules*; the same *Modules* give, likewise, the Heights of the Capital, Architrave, Triglyphs, and Metopes.—But our little *Module* taken from the third of the Diameter of the lower Part of the Column, has Uses much more extensive; for by this the Heights of *Pedestals*, of Columns, and Entablatures, in all the Orders, are determined without a Fraction.—As then the great *Module* or Diameter of the Column has 60 Minutes; and the mean *Module*, or half the Diameter 30 Minutes; our little *Module* has 20.

There are a few Ornaments which we had almost forgot mentioning, as the *Triglyphs*, and *Metopes*, both repeated, only in the *Dorick Freeze*; the *Triglyphs* at equal Intervals.—Each *Triglyph* consists of two entire Gutters or Channels, cut to a right Angle, called *Glyphes*, and separated by three Interstices, called by *Vitruvius* *Femora*, from each other, as well as from two other half Channels, which are at the Sides.

The ordinary Proportion of *Triglyphs*, is to be a *Module* broad, and one and a half high.—But this Proportion *Mr. Le Clerc* observes, sometimes occasions ill-proportioned Intercolumnations in Portico's; for which Reason he chuses to accommodate the Proportion of his *Triglyphs*, to that of the Intercolumns.

The Intervals between the *Triglyphs* are called *Metopes*, which the Antients used to adorn with carved Works or Paintings, representing the Heads of Oxen, Vessels, Basons, and other Utensils of the heathen Sacrifices.

As there is found some Difficulty in disposing the *Triglyphs* and *Metopes* in that just Symmetry which the *Dorick Order* requires; some Architects make it a Rule never to use this Order but in Temples.—*Semi-Metope*, is a Space somewhat less than half a *Metope*, in the Corner of a *Dorick Freeze*.

The *Triglyphs* make the most distinguishing Character of the *Dorick Order*.—Some imagine them originally intended for the Conveyance of the *Gutta* that are underneath them: Others fancy they bear some Resemblance to a Lyre, and thence conjecture the Ornament to have been originally invented for some Temple dedicated to *Apollo*.

Having thus considered all the different Members and Ornaments which enter into the Composition of a Column; we'll proceed to the Demonstration of the five different Orders of Architecture, viz. *Tuscan*, *Dorick*, *Ionick*, *Corinthian*, and *Composite*.

The *Tuscan Order* is the first, simplest, and most massive of the five Orders.—'Tis called by *Vitruvius*, the *Rustick Order*, and therefore, in *M. Cambray's* Opinion, it ought never to be used, but in Country Houses and Palaces; though *M. Le Clerc* believes, That in the Manner *Vitruvius*, *Palladio*, and some others, have ordered it, it does not deserve to be used at all; but that in *Vignola's* Manner of Composition, 'tis a Beauty, even in its Simplicity, and as such, should find Place, not only in private Edifices, but likewise in Publick ones, as in the *Piazza's* of Squares and Markets; in the Magazines and Granaries of Cities, and even in the Offices and lower Apartments in Palaces.

Palladio gives us these Instructions for the *Tuscan Order*; that the Column (b 1) together with its Base, (a 1) and Capital (c 1) must be seven *Modules* in Length, and its Diminution a fourth Part of its Bigness.—That if a Work is to be composed of this plain Order, the Intercolumnations should be very wide, because the Architraves are made of Timber, which, therefore, will be very commodious for Country Buildings, on Account for the easy Passage for Carts and other Country Conveniences.

The same Author observes that the *Pedestals*, (h 1) which are under this Order, must be very plain and simple, and the Height of a *Module*; and that of the

Base of the Column, half its Diameter.—That this Height must be divided into two proportional Parts, one whereof is to go to the *Plinth*, which is round, and the other subdivided into four Parts, one whereof is appropriated to the *Listella* or Fillet, which is sometimes made a little less.—That in this Order only the *Listella* makes a Part of the Base; and a Part of the Column in all the others; the other three Parts being appropriated to the *Torus*.—That this Base ought always to project a sixth Part of the Diameter of the Column.—That the Height of the Capital is half the Diameter of the lower Part of the Column, and is divided into three proportional Parts; the first applied to the *Abacus*, which, from its Form is generally called *Dado*, or a *Dye*; the second to the *Ovolo*; and the third subdivided into seven Parts, the *Listella* under the *Ovolo*, being one of them, and the other remaining six are applied to the *Collorino*, or Neck of the Column.—The *Astragal* (says he) is twice the Height of that of the *Listella*, under the *Ovolo*; and its Centre is made on the Line, which falls perpendicular from the *Listella*, the Projecture of the *Cincture*, which is as thick as the *Listella*, falls directly upon it. The Projecture of this Capital corresponds with the Shaft of the Column below: Its Architrave (e 1) is composed of Timber, the Height whereof must be equal to its Breadth, and its Breadth must never be greater than the Shaft of the Column at Top.—The Joists, which are instead of the *Gutta* or *Drip*, project a fourth Part of the Length of the Column.—The Profiles on the Side of the Plan of the Base and Capital are the Impost of the Arches:

But, continues he, if the Architraves are composed of Stones, you must observe what I have already mentioned, with Respect to the Intercolumnations; and which is the same myself have mentioned at the Beginning of this Treatise, where I speak of Intercolumnations.

Mauclerc will have the Height of the *Tuscan Column*, divided into nine Parts; two whereof are for the *Stilobate*, or *Pedestal*; and those two subdivided into six Parts; one to be applied to the inferior Cimatium, one to the superior, and the four remaining to describe a Square, intercutted by two Diameters or diagonal Lines.—In that Square he would have a Circle made, and another Square in that Circle, which inward Square will be the Swelling of the lower Part of the Column, and the outward one the Breadth of the Plinth of the Base.—He will have the Swelling at Top to be the middle Square, which is to be divided into eight Parts, two whereof will be the Diminution of the Column.—The Projecture of the Cimatium of the Plinth he divided into six Parts, one to project out, in which he places the Square. He also divides the Base of the Column into two Parts, one whereof to be the Plinth, and the other to be subdivided into four, one for the Tailloir over the Listel, and one of the remaining three to be divided into two, one whereof for the Reglet, or Fillet, under the Cornice, which is to project out Square-like. Thereby, says he, the whole Projecture will be the seventh Part of the Breadth of the Pedestal.

In his Opinion, the upper Cimatium, otherwise called the Cornice of the Pedestal, is to be divided into four Parts; one to be applied to the Listel, or Talcar, two to the Plinth, and the Fourth to the Astragal, or Fillet; so that the Astragal might be twice larger than the Fillet.—The Base of the Column is to be divided into two Parts; one for the Plinth, (D 1) and the other subdivided into three; two whereof to be applied to the *Torus*, and the third to the Fillet; so that its whole Projecture is the Interval from the exterior Square to the interior. The Projecture of the Fillet must be a Square from the Column, and the Rest is given to the *Torus*. The Height of the Fust of the Column must be six Parts of its Breadth, with its Cymatium and Capital. The Height of the Capital must be half the Breadth of the lower Part of the Shaft or Fust of the Column, and is to be divided into three Parts, one thereof to be given

given to the *Abacus*, the second to the *Tore*, and the third to the *Freeze*. The *Tore* being divided into four Parts; one is given to the *Fillet*, and the Rest makes up the *Torus*. The *Freeze* (f 1) is divided into two, one for the Breadth of the *Astragal*, and this to be sub-divided into three, one for the *Fillet*, and the two others for the *Astragal*.—The eighth Part of the Breadth of the Fust of the Column below, will be the Projecture of the *Capital*.—He gives the following Directions for the Diminution of the Column.

The Length of the Column between its two *Cymatiums*, is to be divided into six Parts, two thereof for the lower Part of the Column, and make a Third of its Height. Having made the Division from the Bottom to the Top, transversal Lines are to be drawn on each Side, and the Compass applied from one End to the other of the Line of the third Part; the Compass placed on the Side, the Circle is to be divided from one of the Sides of its Semicircle to that Part, where the Line falls perpendicularly for the higher Scope of the Column, to the six Parts of the *Inography* on the *Pedestal*, where they cut the *Semi-round* on the left, into four Parts.—Likewise, from each Part must be drawn a Line upwards, beginning outwards, and proceeding to the sixth Part of the *Fust*; from the second and third of these Lines thus conducted, must be drawn those for the Diminution of the Column.—But to render the Diminution more just, and agreeable to the Eye, he advises, that instead of dividing the Circle into four Parts, it is better to divide that same Space, together with the Column, into 5, 6, 7, or 8, since the great Number of Divisions renders always the Diminution more agreeable and perfect.

Vitruvius, lib. 3. c. 12. gives other Instructions for the Diminution of these Columns, and will have the lower Diameter of a *Tuscan* one, in which is 16 Feet in Height from the *Base* to the *Capital*, divided into six Parts, allowing five for the Top. Those from 15 to 20 Feet, their lower Diameter is to be divided into six Parts and a Half, five and a Half for the Top.—From 20 to 30, the Diameter is divided into seven Parts and a Half, six and a Half whereof are to be given to the Top.—But from 40 to 50, the Diameter must be divided into eight Parts, allowing seven to the Top, from whence will issue a handsome *Diminution*.

The same Author divides the *Architrave*, which he makes half the Breadth of the lower Part of the Column, into six Parts, one he gives to what he calls the superior *Cornice*, and subdivides that also into three, one for the *Fillet*, and the two others for the left *Talon*; but the other five remaining Parts of the *Architrave*, he subdivides into nine, five whereof he gives to the superior *Fascia*, and the four remaining to the inferior, the whole with its Projecture.—He also makes the Height of the *Freeze* half the Breadth of the lower Part of the Column.—Over the *Freeze* he places the *Cornice*, of an equal Altitude with the *Freeze*, whose Projecture on the left Side, is equal to its Height; and is to be divided into four Parts, one for the *Talon*, subdivided into three, one thereof for the *Fascia*, and the two others for the *Talon*; but of the three Parts remaining of the *Cornice*, one he gives to the *Echine*, and to the *Fillet*, and this he subdivides into four, one for the *Fillet*, and three for the *Echine*, and the two Parts remaining of the first three, are for the Projecture, which is equal to the Height.

Others divide the Height given for this whole Order, into ten several Parts, take two for that of the *Pedestal*, and divide the remaining eight Parts into five, one whereof for the Altitude of the *Entablature*, and the other four for the Length of the Column, the *Base*, and the *Capital* included; so that the *Entablature* is by that Means, made one fourth of the Length of the Column.

Having divided the *Entablature* into seven Parts,

they apply two to the *Architrave*, two to the *Freeze*, and two to the *Cornice*; making of four of these Parts, the Diameter of the Column.

They divide the Altitude of the *Pedestal* (h 1) into six Parts; two for the *Base* and *Plinth*; three for the Altitude of the *Dye*; and one for that of the *Cap*.

In Order to find out the Breadth of the *Dye*, the Diameter of the Column is divided into five Parts, and seven such Parts is the Breadth, and is likewise, the Projecture of the *Base* of the Column.

The *Base* of the *Pedestal* is found by the Division of the two Parts allotted for the *Base* and *Plinth*, into three, allowing one to the *Base* and two to the *Plinth*.—The Projecture of the *Cap* and *Base* of the *Pedestal* is equal to the Altitude of the said *Base*.

In Order to diminish the Shafts of the Column, they will have its Diameter taken with Compasses, and find it six Times contained between the *Base* and the *Capital*; at two of which from the *Base*, they make a Semi-circle; then let fall a Perpendicular from the Diameter at Top, and cut the Semi-circle at four; after that divide the Part of the Semi-circle, so cut off into four Parts (because four Parts of the *Shaft* remain above) and raise Perpendiculars from the said Points, to the correspondent Division, which will form a regular Curve for the Swelling.

The Altitude of the *Base* of the Column, is half a Diameter, and is divided into two, allowing one to the *Plinth*, the other Part is divided into four, giving one to the *Fillet*, and three to the *Torus*.—The whole Projection is one Fifth of the Diameter of the Column, and the *Fillet* projects equal to its Altitude.

For the several and respective Members of the *Pedestal*, *Base*, *Plinth*, and *Cap*, they divide the *Base* into three, allowing one to the *Fillet* and three to the *Hollow*.

They divide the Altitude of the *Cap* into four, allowing one to the *Ogee*, two to the *Corona*, and one to the *Band* at Top. For the Projections, they make them both equal to the Altitude of the *Base*, and both being divided into three Parts, they conceive, by Inspection, the Projecture of the several Members.

Having shewn the whole Altitude of the *Entablature* to be one Diameter, and three Fourths, and set off the principal Height of the *Architrave*, *Freeze*, and *Cornice*; as for the particular Members, they divide the *Architrave* into six Parts, allowing two to the first *Fascia*, three to the second, and one to the *Band* at Top.—They make the Projection equal to the Altitude of the first *Band*, and give one Third to the second *Fascia*.

They divide the Altitude of the *Cornice* into nine Parts (*i. e.* each principal Third into three) allowing one and a Half to the *Hollow*, Half to the *Fillet*, one and a Half to the *Ovolo*, two to the *Corona*, Half to a *Fillet*, two to the *Scima recta*, and one to the upper *Fillet*.—They make again the Projection equal to its Altitude, and to contain the same Divisions, pretending the several Divisions to be obvious by the Inspection of the Scales only.

They make the *Capital* half a Diameter in Height, and divide it into three Parts, allowing one to the *Freeze* of the *Capital*, another to the *Ovolo* and *Fillet*, which is one Fourth, and the other Part to the *Abacus*.—Thereby the Projection is one Eighth of the Diameter, which gives likewise, the Diameter of the Column at Top.—The *Fillet* is equal to the Height.

The *Astragal*, or *Collerino*, is one Third of the said *Freeze* of the *Capital* in Height, and the *Fillet* the Height thereof, and is equal to the Height in its Projection.

In the *Tuscan Cornice*, (g 1) as well as in all others, they preserve the principal Divisions, both with Respect to the Height and Projection, and introduce them again, with no other Intent but to corroborate the

the Rules, and to shew the Method of forming the several and respective Mouldings, and which they suppose discernable by Inspection.

Of all the Orders the *Tuscan* is the most easily executed, as having neither *Triglyphs*, nor *Dentils*, nor *Modillions* to cramp its Inter-columns.——On this Account, the Columns of this Order may be ranged in any of the five Manners of *Vitruvius*, viz. the *Pycnostyle*, *Systyle*, *Eustyle*, *Diastyle*, or *Aræostyle*.

The *Tuscan Order* takes its Name from an antient People of *Lydia*, who coming out of *Asia* to people *Tuscany*, first executed it in some Temples which they built in their new Plantations.

The *Dorick* is the second of the five Orders, being that between the *Tuscan* and *Ionick*.——'Tis the most natural and the best proportioned of all the Orders; all its Parts being founded on the natural Position of solid Bodies.——At its first Invention it was more simple than at present; and when in Process of Time they came to adorn and enrich it more, the Appellation *Dorick* was restrained to its richer Manner, and the primitive simple Manner, they called by a new Name, *Tuscan Order*.

Sometime after its Invention they reduced it to the Proportion, Strength, and Beauty of the Body of a Man. Hence, as the Foot of a Man was judged the sixth Part of its Height, they made the *Dorick* Column, including the *Capital*, six Diameters high, i. e. six Times as high as thick.——Afterwards they added another Diameter to the Height, and made it seven Diameters; with which Augmentation, it might be said to be near the Proportion of a Man: The human Foot, at least in our Days, not being a sixth, but nearly a seventh Part of the Body.

The Characters of the *Dorick Order*, as now managed, are the Height of its Column, which is eight Diameters; its *Freeze*, which is enriched with *Triglyphs*, *Drops*, and *Metopes*; its *Capital*, which is without *Volutes*, and its admitting of *Cymatiums*.

Vitruvius complains of the *Dorick*, as very troublesome and perplexing, on Account of the *Triglyphs* and *Metopes*, so as scarce to be capable of being used, except in the *Pycnostyle*, by putting a *Triglyph* between two Columns; or in the *Aræostyle*, by putting three *Triglyphs* between each two Columns.

The Moderns, on Account of its Solidity, use it in large, strong Buildings; as in the Gates of Cities and Citadels, the Outsides of Churches, and other massy Work, where Delicacy of Ornament would be unsuitable.

Vignola adjusts the Proportions of the *Dorick Order*, Thus: The whole Height of the Order, without *Pedestal*, he divides into twenty Parts or Modules; one of which he allows the *Base*, fourteen to the Shaft or *Fust*, one to the *Capital*, and four to the *Entablature*.

Palladio will have the *Module* of this Order be but half the Diameter of the Column, divided into thirty Minutes, whereof in the other Orders, he makes it the whole Diameter, divided into sixty.

The same Author will have the *Dorick Column*; if insular without *Pires*, to be eight Diameters in Length, or seven and a Half at least; and seventeen *Modules*, and a Third (including the *Base* and *Capital*) when joined to *Pires*.

He observes, that when a *Pedestal* (h 2) is to be joined to this Order (which he says was not the Custom of the Antients) the *Dado* or *Dye*, must be square, from whence the Measure of its Decorations must be taken; therefore he divides it first, into three proportional Parts, allowing two for the *Base* and its *Plinth*, and the third for the *Cymatium*, whereto the *Plinth* of the *Base* of the Column must be joined.

He supposes no peculiar *Base* (a 2) to this Order, which is the Reason he gives for these Columns being found without *Bases* in several Buildings, as the Theatre of *Marcellus* at *Rome*; the Temple de la *Pieta*, adjacent to it, the Theatre of *Vicenza*, &c. but pretends the *Attick Base* to be a great Ornament to it.—He then proceeds to give us the exact Measures

thereof.—He will have its Height half the Diameter of the Column, and divided into three proportional Parts; one for the *Plinth*, and the other two subdivided into four proportional Parts; one for the upper *Torus*, the other three subdivided again, into two proportional Parts; one whereof is the lower *Torus*, and the other the *Cavetto*, with its *Listella's*.——He also gives these their particular Measure, and divides them into six Parts; the first for the upper *Listella*, the second for the lower, and the four others for the *Cavetto*.——He makes the whole Projecture, the sixth Part of the Diameter of the Column, and the *Cincture* half the upper *Torus*.——In Case he divides it from the *Base*, he makes its Projecture a Third of that of the *Base*; but in Case the *Base* and Part of the Column make one perfect Piece, he'll have then its *Cincture* small.

The *Capital*, (c 2) says he, must be half the Diameter of the Column, and divided into three Parts, the first whereof subdivided into five Parts, of which three are for the *Abacus*, and the other two for the *Cymatium*; which being subdivided into three Parts, the first goes to the *Listella*, and the two last to the *Cymatium*.——The second principal Part he subdivides into three proportional Parts; one for the *Anulets* or *Squares*, which are all proportional; the other two for the *Ovolo*, the Projecture whereof he makes two thirds of its Height; allowing the third principal Part for the *Collorino*, so that the entire Projecture must be the fifth Part of the Diameter of the Column.

He makes the Height of the *Astragal* proportional to the three *Listella's*, and to project to the lower Part of the Shaft of the Column; and the *Cincture* half the Height of the *Astragal*, and its Projecture direct with its Center.——The *Architrave* (e 2) raised upon the *Capital*, and whose Height must be half the Diameter of the Column, (b 2) he divides into seven Parts, one for the *Tenia* or *Fillet*, whose Projecture is proportional to its Height, and afterwards subdivides the whole into six Parts, one for the *Gutta*, of which there must be six, and the *Listel* under the *Tenia*, which he makes a third Part of the *Gutta*.——The Remainder from the *Tenia* downwards, he subdivides into seven Parts; three of them for the first *Fascia*, and the other four for the second.——He makes the *Freeze* (f 2) a *Module* and a half high, the Breadth of the *Triglyph* a *Module*, and its *Capital* the sixth Part. The *Triglyph* he divides into six Parts; two whereof are for the two Channels in the Middle, one for the two half Channels at the Ends, and three for the Spaces between the said Channels.——He'll have the *Metope*, which is the Space between the *Triglyphs*, a perfect Square.——He'll have also the *Cornice* (g 2) a *Module*, and a sixth in Height, and divided into five Parts and a half, two for the *Cavetto* and *Ovolo*, (the *Cavetto* to be less than the *Ovolo*, and exactly as much as its *Listella*) the other three and a half for the *Corona*, and both the *Cimas*, the *Reña* and the *Reversa*.

He makes the Projecture of the *Corona*, two Thirds of a *Module*, and in the Face thereof, which looks downwards, and projects along the *Triglyphs*, places six *Gutta* in Length, and three in Breadth, with their *Listella's*, and some *Roses* over the *Metope*.——The *Gutta* are round in the Form of Bells, and answer to those under the *Tenia*.——The Body of the *Cymatium* is one Eighth larger than the *Corona*, and is divided into eight Parts, two for the *Plinth*, and six for the *Cymatium*, the Projecture whereof is seven and a half: So that the Altitude of the *Architrave*, the *Freeze* and *Cornice*, are a fourth Part of the Height of the Column.

Most of the *Architects* divide the Altitude given for this whole Order, first into ten Parts, allowing two to the *Pedestal*, and dividing the remaining eight Parts into five; then give four to the Length of the Column, including the *Base* and *Capital*, and reserve the other one for the *Entablature*, which they divide into four Parts, two whereof they make the Diameter of

of the Column: Thus the Column will be eight Diameters high, and the *Entablature* one fourth of the Length of the Column.— Having divided the *Architrave* into four, they give one to the *Architrave*, one and a half to the *Freeze*, and one and a half to the *Cornice*.— They make the *Architrave* to project one Sixth of its Height, and the *Cornice* a Diameter of the Column; that is to say, four such Parts as it is three in Height.— The Height of the *Pedestal* they divide into seven Parts, allowing two to the *Base* and *Plinth*, four to the *Dado*, or *Dye*, and one to the *Cap*.

They diminish the Column one Sixth of the Diameter, from one Third of the Length of the Shaft or Fust; and say, that if the Diameter at Bottom be divided into five, the *Base* of the Column will project, on each Side, one of these Parts, which will give the Breadth of the *Dado* of the *Pedestal*, and by that means make it a Square.— They make the *Base* of the *Pedestal* one Third of the two Parts for the *Base* and *Plinth*, and its Projection equal to the Height, and the *Cap* to project four Fifths of the Height.

They make the Height of the *Base* of the Column half the Diameter, and the Projection to give the Breadth of the *Pedestal*, which is a Diameter, and two Fifths.

For the particular Members of the *Pedestal* they divide the Height of the *Base* into six, giving three to the *Torus*, one to the *Fillet*, and two to the *Hollow*, pretending that the Projection being the same Parts, each Member is easy to set off by Inspection.— They divide the *Cap* into five Parts, giving one to the *Hollow*, half a Part to the *Fillet*, one and a half to the *Ovolo*, one and a half to the *Corona*, and half a Part to the *Fillet* at Top; therefore the Projection must have four of these Parts.

The Height of the *Base* of the Column they divide into three Parts, one for the *Plinth*, the Half of another for the upper *Torus*, and the Half of the Remainder for the lower *Torus*; then the remaining three Fourths are divided into six, one for each *Fillet*, and four for the *Scotia*.— They make the whole Projection one Fifth of the Diameter, and dividing it into three, they give one to the upper *Fillet*, which is Part of the Column, and is double the Height of the others, and another to the upper *Torus*.

They make a *Dorick* fluted Column (b 2) with twenty in Number, fluted to an Edge, some making their Form or Depth by the Center, being in the Middle of a Square; others by the Joint of an equilateral Triangle.

Having made the whole Height of the *Entablature* two Diameters, they divide it into four, one for the *Architrave*, one and a half for the *Freeze*, and one and a half for the *Cornice*.— As for the particular Members they divide the *Architrave* into six; two for the first Face, three for the second, and one for the Band at Top. They allow one of these Parts to the *Gutta* or Bells, and a Third thereof to their *Fillet*; as well as to the Projection.— They adorn the *Freeze* with *Triglyphs*, which are half a Diameter in Breadth, one whereof they place in the Middle of the Column, and make the *Metope*, or Place between, equal to the Height of the said *Freeze*.— They, afterwards, divide the *Triglyphs* into twelve Parts, allowing one to each half Channel, two to each whole Channel, and two to each of the Space between the Channels.— They make the Projection of the *Triglyph* one and a half of these Parts.

They divide the Height of the *Cornice* into three, and divide again the lower Part into three; one gives the *Cap* of the *Triglyph*, one the *Hollow* and *Fillet*, (which is one Fourth) and the other the *Ovolo*.— The other two Parts they divide into seven, allowing two to the *Mutule*, and *Cap*, two to the *Corona*, one to the *Scima Reversa* and *Fillet*, and two to the *Scima Reversa* and *Fillet*, and discover the smaller Divisions by Inspection.

As to the *Projections* the whole being four such Parts as the three in Height, they divide again the first of

them into three, allowing one to the *Cap* of the *Triglyph*, another to the *Cavetto*, and the other to the *Ovolo*.— The outer Part they subdivide likewise into seven, which regulate the *Scima* and *Corona*.

The Height of the *Capital* they divide into three, one gives the *Freeze* of the *Capital*, another the *Fillets* and *Ovolo*, and the third the *Abacus Scima Reversa* and *Fillet*; but to be more particular, the middle Part is divided into three, allowing one to the *Fillets*, which are three, and equal, or (as on the other Side) one to a *Fillet*, and two to an *Astragal*; the upper third Part they divide into five, allowing three to the *Abacus*, and two to the *Scima Reversa* and *Fillet*, which is one third.— They make the Projection equal to the Height of the *Freeze*, and *Fillets* together, and from its being divided into four, expect the Rest to be seen at once.

To regulate the *Intercolumnations* in the *Dorick Order*, it must be done according to the Number of *Triglyphs* intended between, allowing for one *Triglyph* between, one Diameter and a half; for two *Triglyphs* two and three Fourths, and for three *Triglyphs* four Diameters.

As for the Invention of the *Dorick Order*, the Tradition is, that *Dorus* King of *Achaia*, having first built a Temple of this Order at *Argos*, which he dedicated to *Juno*, occasioned it to be called *Dorick*; though others derive its Name, we know not how, from its being invented or used by the *Dorians*.

The *IONIC COLUMN* (b 3) is the third in Order, and is distinguished from the *Composite*, in that it has none of the Leaves of the *Achæntus* in its *Capital*; and from the *Tuscan*, *Dorick* and *Corinthian*, by the *Volutes* or Rams-horns, which adorn its *Capital*, and from the *Tuscan* too by the Channels, or Flutings in its *Shaft*.

This Column is a Medium between the massive and delicate Orders, the simple and the rich.— Its Height is eighteen *Modules*, or nine Diameters of the Column taken at the Bottom. When it was first invented its Height was but sixteen *Modules*; but the Antients, to render it still more beautiful than the *Dorick*, augmented its Height by adding a *Base* to it, which was unknown in the *Dorick*.

M. Le Clerc makes its *Entablature* four *Modules* and ten Minutes, and its *Pedestal* (h 3) six entire *Modules*; so that the whole Order makes twenty-eight *Modules* ten Minutes.

Palladio will have this Column with its *Capital* (c 3) and *Base* (a 3) nine *Modules* high, (making the *Module* a Diameter of the Column below).— Its *Architrave*, (e 3) *Freeze*, (f 3) and *Cornice*, (g 3) are a fifth Part of the Height of the Column, and the *Intercolumnations* two Diameters and a Quarter, which he believes the most commodious, and the most fit to strike the Eye agreeably.

In the *Arches* where the *Ionick Columns* are to have *Pedestals*, he makes their Height equal to half the Breadth of the Opening of the Arch, and divides it into seven Parts and a half, two for the *Base*, one for the *Cymatium*, and the other four and a half for the *Dado*.— He makes the *Base* of the *Ionick Order* half a *Module* thick, and divides it into three Parts, one for the *Plinth*, the Projection whereof is the fourth, and an eighth Part of the *Module*, dividing the other two into seven Parts, three whereof he gives to the *Torus*, subdividing the other four into two Parts, one for the upper *Cavetto*, and the other for the lower *Cavetto*, which ought to have the greatest Projection.— He has the *Astragals*, the eighth of the *Cavetto*, the *Cincture* of the Column the third Part of the *Torus* of the *Base*, provided the *Cincture* be not joined to the *Base* of the Column, for in that Case he makes it smaller, making its Projection half of that above-mentioned.

To make the *Capital*, he divides the Diameter at the *Base* of the Column into eighteen Parts, and nineteen of such Parts make the Length and Breadth of the *Abacus*, one Half whereof is the Height of the *Capital*, with its *Volutes*, whence its Height must be nine

nine Parts and a Half; one and a Half whereof is for the *Abacus* with its *Cymatium*, and the other eight for the *Volute*, which he makes after this Manner:

He takes one of the nineteen Parts from the End of the *Cymatium*, inward, and from the Point made, he lets down a Plum-line to divide the *Volute* in the Middle.—Where the Point falls upon this Line, which separates the four Parts and a Half above, from the three and a Half below, the Centre of the *Volute* is made, whose Diameter is one of the eight Parts; and from the aforesaid Point he draws a Line, which as it cuts the *Catheto* at right Angles, divides the *Volute* into four Parts.—Then he makes a Square in the Eye of the *Volute*, about the same Bigness as the Semi-diameter of the same Eye; and drawing diagonal Lines, he marks the Points upon them, where the fixed Foot of the Compass must stand to make the *Volute*; which Points or Centers are thirteen in Number, the Eye inclusive.—He places the *Astragal* of the Column in a direct Line with the Eye of the *Volute*.—He makes the Thickness of the *Volute*, in the Middle, in Proportion to the Projecture of the *Ovolo*, which must project beyond the *Abacus*, just as much as the Eye of the *Volute*.—The Channel of the *Volute* is even with the *Shaft* of the Column.—The *Astragal* of the Column goes under the *Volute*, and is always seen.

Palladio usually makes *Capitals* in the Angles of Colonnades or Portico's of the *Ionick Order*, with *Volute*s, not only in the Front, but also in that Part which would have been the Flank, in Case the *Capital* was to be made as generally it is; by which Means they have the Front on two Sides, and are called by him *Angular Capitals*.

The same Author makes the *Architrave*, *Freeze*, and *Cornice*, a fifth Part of the Altitude of the Column, and divides it into twelve Parts; some whereof are for the *Architrave*, three for the *Freeze*, and five for the *Cornice*.—The *Architrave* he subdivides into five Parts, one for the *Cymatium*, and the Remainder is again subdivided into twelve Parts; three whereof are for the first *Fascia* and its *Astragal*, four for the second, and five for the third.—He divides the *Cornice* into seven Parts and three-fourths, two for the *Cavetto* and the *Ovolo*, two for the *Modillion*, and three and three-fourths for the *Corona* and the *Cymatium*. The Projecture or jetting out of the whole *Cornice*, he renders proportional to its Altitude.

Others divide whatever Height be given for the whole Order, into ten Parts, and allowing two to the *Pedestal*, divide the remaining eight into six, giving one to the *Entablature*, and five to the Length of the Column, inclusive of the *Capital* and *Base*.—The said Length being divided into nine Parts, they find it to be the Diameter of the Column, which, like most of the other *Architects*, they make use of to regulate some of the smallest Members.

The Height of the *Entablature* they divide into six, allowing two to the *Architrave*, one and a half to the *Freeze*, and two and a half to the *Cornice*, making the Projecture of the *Architrave* one-fourth of its Height, and that of the *Cornice* equal to its Height.—They divide the Height of the *Pedestal* into seven Parts, allowing two to the *Base* and *Plinth*, four to the *Dado*, and one to the *Cap*.

They diminish the Column one Sixth of the Diameter, from one Third of the Length of the *Shaft*, in the same Manner as the last Order, and the *Base* of the Column projects the same, which gives them likewise the Breadth of the *Dado* of the *Pedestal*.—They make the *Base* of the *Pedestal*, one Third of the two Parts given for the *Base* and *Plinth*, and the Projection thereof equal to the Height, and the *Cap* to project three Fourths of its Height.

They make the Height of the *Base* of the Column half the Diameter, and the Projection one-fifth Part of the whole Diameter, which gives the Breadth of the *Pedestal*; for the principal Members thereof they

divide the Height of the *Base* into four Parts, allowing half a Part to the *Fillet*, two to the *Cymate*, one half Part to the *Fillet*, and one to the *Hollow*.—The Projection being equal to the Height, and divided into the same Number of Parts, the Members, say they, appear by Inspection.—They likewise divide the *Cap* into four Parts, allowing one to the *Hollow* and *Fillet*, which is one-fourth, another to the *Ovolo*, another to the *Corona*, and one to the *Ogee* and *Fillet*, which is one Third.—They make the whole Projection three of the four Parts of the Height, and dividing each Third into three, they set off as to appear by Inspection.

The *Base* of the Column they divide into three Parts, one for the *Plinth*, and the other two as they are divided in the *Dorick Order*.—They make the *Bead* above the upper *Torus*, Part of the Column, and double the Height of the *Fillet*s; and the *Fillet* above the said *Bead* equal to the others, and the Projection the same as in the *Dorick*.

They make twenty-four Flutes in the fluted Columns of the *Ionick*, each of a Semicircle in Depth, and the *Lift* or *Fillet*, between each one Third of the said Flutes.

The whole Height of the *Ionick Capital*, (c3) which they conceive to be more difficult than the former, is made half a Diameter, which being first divided into three Parts, the upper Part is for the *Abacus*, which is divided again into three, one for the upper Part, half a Part for the *Fillet*, and one and a half for the lower Part. From the Middle of the said *Abacus* downwards, 'tis divided into eight Parts, allowing two and an half from the Bottom of the *Volute* to the *Fillet*, half a Part to the *Fillet*, one to the *Astragal*, and two to the *Ovolo*.

The whole Height of the *Entablature*, they divide into six Parts (as before mention'd) allowing two to the *Architrave*, one and an half to the *Freeze*, and two and an half to the *Cornice*; as for the particular Members, the *Architrave* (c3) being divided into two Parts, each is subdivided into eight, in all sixteen, allowing three to the first Face, four to the second, five to the third, one to the *Bead*, two to the *Ogee*, and one to the *Fillet*.—They make the Projection one Fourth of the Height, and the upper Face one Third thereof.—They form the *Freeze* (f3) by making a Triangle on the middle Part of three in its Height, whose opposite Angle is the Center for the Curve or Swelling.

They divide the Height of the *Cornice* (g3) into eight Parts, allowing one to the *Hollow* and *Fillet*, (which is one Fourth) another to the *Ovolo*, and two more to the *Modillion* and *Cap* (which is half a Part) the upper four Parts they subdivide into five, giving two to the *Corona*, one to the *Scima Reversa* and *Fillet* (which is one Fourth) one and an half to the *Scima Recta*, and half a Part to the *Fillet*.—They make the whole Projection equal to the Height, and divide it into nine Parts (each being one Twelfth of the Diameter) and as to the several Members, they refer to a due Inspection.

The *IONICK ORDER* owes its Origin to *Ionia*, a Province of *Asia*, and it is said the Temple of *Diana* at *Ephesus*, the most celebrated Edifice of all Antiquity was of this Order.—The *Ionick* has an Advantage above any of the rest; and it consists in this, that the fore and hind Parts of its *Capital* are different from its Sides. But this is attended with an Inconvenience, when the Ordonnance is to turn from the Front of the Building to the Sides, to obviate which, the *Capital* may be made angular, as is done in the Temple of *Fortuna Virilis*.

Scamozzi, and some other modern *Architects*, have introduced the upper Part of the *Composite Capital* in lieu of the *Ionick*, imitating that of the Temple of *Concord*, whose four Sides are alike; to render it more beautiful, the *Volute* may be made a little oval and inclining.

At present the *Ionick Order* is properly used in Churches and religious Houses, in Courts of Justice and

and other Places of supposed Tranquillity, and Devotion.

The CORINTHIAN ORDER, the fourth, or as *Scamozzi* and *M. Le Clerc* make it, the fifth, and last of the Orders of *Architecture*, is the noblest, richest, and most delicate of them all.

The *Corinthian* has several Characters whereby 'tis distinguish'd from the rest.—Its *Capital* (c 4) is adorned with two Rows of Leaves, between which rise little Stalks, or Caulicoles, whereof the *Volutes* are form'd, which support the *Abacus*, and are sixteen in number.—It has no *Ovolo*, nor even *Abacus*, properly speaking; for the Member that goes by that Name is quite different from the *Abacus* in the other Orders; being cut with a Sweep, in the Middle, on which is carved a *Rose*, or other Ornament.

Vitruvius observes, that the *Corinthian* Order has no particular Ordonnance for its *Cornice*, or any of the other Ornaments of its *Entablature*; nor does he give it any other Proportions than those of the *Ionick* Order; so that if it appears higher than the *Ionick*, it is purely owing to the Excess of the Height of its *Capital*.—He also makes the rest of the *Entablature* the same; and the *Attick Base* he uses indifferently for the one and the other.

But we have several Examples now remaining of Antiquity, which contradict *Vitruvius's* Opinion; the most beautiful whereof have a particular *Base* (a 4) and the whole Order twenty *Modules* in Height: whereas the *Ionick* has but eighteen.—Again, its *Capital* is higher than that of *Vitruvius* by one-third of a *Module*; and its *Entablature*, which has *Modillions*, and sometimes *Dentils* together with *Modillions*, is very different from the *Ionick Entablature*.

Most of the modern *Architects* set aside *Vitruvius's* *Corinthian* Ordonnance, and follow that of the antient Building; selecting from them according to their several Tastes: So that modern *Corinthian* is a Kind of *Composite*; differing from any of the antient Buildings, and much more from *Vitruvius's* Rules.

Vignola, and *M. le Clerc* make the *Corinthian* Orders twenty *Modules* high: Yet *Serlio* makes it only eighteen; and *Mr. Perrault* eighteen and two-thirds, retrenching something from the nineteen of *Vitruvius*.—The Height of the Shaft, *M. Perrault* makes less than that of the *Ionick*, by reason of the Excess of its *Capital*.

Palladio makes the *Corinthian* Columns nine *Modules* and an half in Height, including both their *Base* and *Capital* (and in Case they are to be fluted) with twenty-four *Flutes* or Hollows, whose Depth is in Proportion to half their Breadth.—The Plan, or Interval between two *Flutes*, he makes one Third Part of the Breadth of those *Flutes*. The *Architrave*, (e 4) *Freeze*, (f 4) and *Cornice*, (g 4) are a fifth Part of the Height of the Column.—He will have the Altitude of the *Pedestal* one fourth Part of the Height of the Column, and divides it into eight Parts; one for the *Cymatium*, two for the *Base*, (a 4) and the other five for the *Dye*.—when he has divided the *Base* into three Parts; two of them go to the *Plinth*, (D 4) and one to the *Mouldings*. Like *Vitruvius* he sets the *Attic Base* under this Order, but different from that which is placed under the *Doric*, the Projection thereof being one fifth Part of the Diameter of the Column.

He makes the Height of the *Corinthian Capital*, the Diameter of the Column below, and a Sixth which he allows to the *Abacus*, the Residue he divides into three proportional Parts; the First is for the first Row of Leaves, the Second for the middle Row, and the Third he subdivides into two Parts; the Caulicoles, or Stalks, together with their Leaves, which are, as it were, supported by them, and out of which they grow, he makes of the Part which is nearest the *Abacus*: The Stalk thereof, or *Rust*, from whence they spring, he will have thick, and to decrease gradually in their Foldings, like Plants which are thicker at the Bottom than at the End of their Branches.—He makes the *Campana*, or Bell, which is the Stalk

of the Column under the Leaves; perpendicular to the Bottom of the *Flutes* of the Column.

In order to give the *Abacus* a proper Projection, he forms a perfect Square, the Side whereof is a *Module* and a Half; in which Square he draws diagonal Lines, the Point of the Intersection thereof; is in the Center, on which he places the Foot of the Compass, and makes a *Module* towards each Angle; drawing Lines which cut the said Diagonals at Right Angles, where these Points meet, so as to touch the Sides of the Square; and these are his Limits of the Projection, whose Length gives the Breadth of the Horns of the *Abacus*. To make its Curvature, or Diminution, he draws a circular Line from one Horn to the other, and makes the Point; whereby an equilateral Triangle is made, the Base whereof is the Diminution.

Afterwards he draws a Right Line from the Ends of the before-mentioned Horns to the End of the *Astragal* of the Column; which he makes so as to be touched by the Tips or Ends of the Leaves; and this he gives for their Projection.—He makes the *Rose* a fourth Part as broad as the Diameter of the Column at the Foot.—Having made the *Architrave*, *Freeze*, and *Cornice*, a fifth Part of the Altitude of the Column; he divides the whole into twelve Parts, as in the *Ionick*, but varies in this, that he divides the *Cornice* of the *Corinthian* into eight Parts and a Half, giving the First to the *Cima Reversa*; the Second to the *Dentils*, the Third to the *Ovolo*, and the Fourth and Fifth to the *Modillions*, and the other three and a half to the *Corona* and the *Cymatium*.—The Projection of the *Cornice* is in Proportion to its Height.—He has the Pannels of the *Roses* between the *Modillions*; square, and the *Modillions*, half as broad as the Plan of the said *Roses*.

The Height given for the *Corinthian* Order, is also often divided into ten Parts, giving two to the *Pedestal*, (h 4) and dividing the other eight Parts into six, five for the Length of the Column, with the *Base* and *Capital*, and the other for the Height of the *Entablature*.—They afterwards divide the Length of the Column into nineteen Parts, and make two of them the Diameter of the said Column; from whence they form several of the minuter Parts.

They divide the Height of the *Entablature* into six Parts, giving two to the *Architrave*, one and a half to the *Freeze*, and two and a half to the *Cornice*; making the Projection of the *Architrave* one Fourth of its Height, and that of the *Cornice* equal to its Height.

The Height of the *Pedestal* is divided into seven Parts, two for the *Base* and *Plinth*, four for the *Dado*, and one for the *Cap*.

They diminish the Column in the same Manner as in the last Order, and by taking the Height of the *Pedestal*, they give the Projection of the *Base* of the Column, and the Breadth of the *Dye* of the *Pedestal*. They make the *Base* of the *Pedestal* of one Third of the two Parts allotted for the *Base* and *Plinth*, and the Projection thereof equal to the Height; and the *Cap* three Fourths of the Height.

They make the Height of the *Base* of the Column, half a Diameter, and find its Projection by taking half the Height of the *Pedestal*, which, also, is the Breadth of the *Dye*.

For the particular Members of the *Pedestal*, they divide the Height of the *Base* into three Parts, giving one to the *Torus* and *Fillet*, which is one Fourth, another to the *Cymase*, and the third to the *Ogee* and *Fillet*, which is one Fourth also. — The whole Projection they make equal to the Height, and dividing it into five Parts, give two to the *Ogee*, two to the *Cymase*, and the other to the *Torus*.—The *Cap* is divided into four Parts, half a Part for the *Hollow*, one Fourth to the *Fillet*, one to the *Cymase*, one Fourth to the *Fillet*, one entire Part to the *Corona*, and one to the *Ogee* and *Fillet*, which is one Third Part thereof.—They make the whole Projection

three Parts of those four in Height, which dividing into four, they set off by Inspection.

They divide the Height of the *Base* of the Column into three, one for the *Plinth*, subdividing the upper two into five, giving one and a half to the lower *Torus*, one to the upper *Torus*, one to the *Scotia*, and the other one and a half to the *Fillets* and *Beads*, viz. half a Part to each *Bead*, and one Fourth to each *Fillet*, the *Bead* above the upper *Torus* (being Part of the Column) is as large as the *Fillet* and *Bead* together, and its *Fillet* the Half thereof.

To find the Height of the *Corinthian Capital*, they divide the Diameter of the Column into six Parts, and make one whole Diameter and one of these Parts the Height.—Those six Parts they allow for the *Abacus*, which dividing into two, they give one to the Hollow, and the other to the *Ovolo* and *Fillet*.—To each Height of Leaves they give two of the six Parts, the remaining Diameter is divided into, and make the Heads of those Leaves to turn down half a Part.—They divide again the under one, of the upper two Parts into two, the Heads of the Leaves turning down one Part, and the upper one into three, giving one to the *Fillet*, and two to the small *Volutes*; the large *Volutes* having the entire Part.—The *Rose* they made as high as the *Abacus* and the *Fillet* together.

They make no other Difference between the Projections of this Order, and those of the foregoing one, but by observing in the Circumference of the Column, that there are eight Leaves in each Height, and that each Leaf has four Plants carved with Olive, Parsley, &c. according to Fancy; limiting the Projection of their Heads, by a right Line drawn from the Projecture of the *Abacus* to the *Collerino*, or *Astragal* of the Column.

Having divided the whole Height of the *Entablature*, into six, they give two to the *Architrave*, one and a Half to the *Freeze*, and one and a Half to the *Cornice*; and to make up the particular Members, they halve each of the two principal Parts the *Architrave* is divided into, and then divide the lower Part into three, giving two to the lower Face, and half a Part to the *Bead*; dividing also a second Part of the four into three, allowing one to the *Ogee*; also dividing the upper fourth Part into three, giving half a Part to the *Bead*, one and a Half to the *Ogee*, and one to the upper *Fillet*, making the Projection one of those Fourths in Height, of which they give Half to the middle Face.

For the *Cornice*, they divide its Height into eight Parts, one for the *Ogee* and *Fillet*, another for the *Dentils*, another for the *Ovolo* and *Fillet*, and the other is divided into six, one Fourth whereof they give to the *Fillet* under the *Modillions*, one and one Fourth to the *Modillion*, half a Part to the *Ogee* and *Fillet*, one and a Half to the *Corona*, half a Part to the *Ogee*, one Fourth to the *Fillet*, one and one Fourth to the *Scima Recta*, and half a Part to the *Fillet*, making the whole Projecture equal to the Height, and dividing it into the same Number of Parts.

Callimachus, a *Corinthian* Sculptor, is thought by most of the modern Writers to have been the Inventor of this Order of *Architecture*, and that passing by the Tomb of a young Lady, over which her Nurse had placed a Basket with some of her Play-things, and covered it up from the Weather with a Tile; the whole having been placed on a Root of *Achantis*; as it sprung up, the Branches encompassed the Basket, and bending down A-top under the Corner of the Tile, formed a Kind of *Volutes*; hence *Callimachus* took his Hint: The Basket he imitated in the *Vase* of his Column; the Leaves in the *Volutes*, and the Tile in the *Abacus* of his Order.—*Villalpandus* treats this Story of *Callimachus*, as a Fable; and will have the *Corinthian Capital* to have taken its Origin from an Order in *Salomon's Temple*, the Leaves whereof were those of the Palm Tree.

The *Composite* (so called from its *Capital* (c 5) being composed out of those of the other Orders) is

the last of the five Orders of *Architecture*.—It borrows a Quarter-round from the *Tuscan*, and *Dorick*; a double Row of Leaves from the *Corinthian*, and *Volutes* from the *Ionick*.—Its *Cornice* has simple *Modillions* or *Dentils*.

Scamozzi, and *M. Le Clerc*, place this Order between the *Ionick* and *Corinthian*, out of a View to its Delicacy and Richness, which they esteem inferior to the *Corinthian*, and therefore make no Scruple to use it under the *Corinthian*, tho' most Authors rank it after the *Corinthian*.

The Proportions of this Order are not fixed by *Vitruvius*; he only marks its general Character, by observing that its *Capital* is composed of several Parts taken from the *Dorick*, *Ionick*, and *Corinthian*: He does not seem to regard it as a particular Order; nor does he vary it at all from the *Corinthian*, except in its *Capital*.—In Effect it was *Serlio* who first added the *Composite Order* to the four of *Vitruvius*, forming it from the Remains of the Temple of *Bacchus*, the Arches of *Titus*, *Septimus*, and the Goldsmiths: Till then this Order was esteemed a Species of the *Corinthian*, only differing in its *Capital*.

This Order being thus left undetermined by the Antients, the Moderns have a Sort of Right to differ about its Proportions, &c. *Scamozzi*, and after him *Mr. Le Clerc*, makes its Column (b 5) 19 Modules and a Half, which is less by half a Module, than that of the *Corinthian*; as in Effect the Order is less delicate than the *Corinthian*.—*Vignola* makes it 20, which is the same with that of its *Corinthian*; but *Serlio*, who first formed it into an Order, by giving it a proper *Entablature* and *Base*, (a 5) and after him *M. Perrault*, raise it still higher than the *Corinthian*.—This last does not think different Ornaments and Characters sufficient to constitute a different Order, unless it have a different Height too; agreeably to his Rule of augmenting the Height of the several Columns by a Series of two Modules in each; he makes the *Composite* twenty Modules, and the *Corinthian* eighteen; which it seems is a Medium between the Porch of *Titus*, and the Temple of *Bacchus*.

Palladio makes the Columns of the *Composite* ten Modules long; and the Intercolumnation in the Designs of Colonades, one Diameter and a Half.—He makes this Order slenderer than the *Corinthian*, and its *Pedestal* (c 5) one Third of the Altitude of the Column, and which he divides into eight Parts and a Half, the first for the *Cymatium*, and five and a Half remaining for the *Dado*.—He subdivides the *Base* of the *Pedestal*, into three Parts, two he allows for the *Plinth*, and one for the *Torus*, with its *Cymatium*.—He makes indifferently the *Base* of this Column, *Attick*, or a Compound of the *Attick* and *Ionick*.

He gives to the *Composite Capital* (c 5) the same Measures with the *Corinthian*, but varies from it in the *Volutes*, the *Ovolo* and *Astragal*, which he cuts into Beads; which Members he borrows from the *Ionick*, and which he makes thus.—He divides the *Capital* from the *Abacus* downwards into three Parts; the first he allows to the first Row of Leaves, the second to the middle Row, and the third to the *Volutes*, which takes up so much of the *Abacus*, that it seems to go out of the *Ovolo*, near the Flower which is placed in the Middle of the Curvature of the *Abacus*, and is as thick in Front as the Breadth of its *Horns*, or little more.—The Thickness of the *Ovolo* he makes three Fifths of the *Abacus*, and its lower Part to begin parallel to the Eye of the *Volute*; giving to its Projecture, three Fourths of its Altitude.—He makes the *Astragal* one third Part of the Altitude of the *Ovolo*, and its Projecture a little more than half its Thickness, and to wind about the *Capital* under the *Volute*, so as to be always visible.—To the *Lustella* which is under the *Astragal*, and forms the *Plinth* of the *Bell* of the *Capital*, he gives half the *Astragal*, making the Body of the *Bell* perpendicular to the Bottom of the Flutes of the Column.

A great Number of modern Architects divide the Height

Height given for this Order into ten Parts, two thereof for the *Pedestal*, and dividing the eight remaining Parts into six, one for the Height of the *Entablature*, and five for the Length of the Column, with *Base* and *Capital*.—That Length they divide into ten Parts, which is no more than halving each of the five Parts, and that is the Diameter of the Column below. So will the *Pedestal* (h 5) be three Diameters, the Column ten, and the *Entablature* two in Height.—Having divided the *Entablature* into six, they give two to the *Architrave* (E 5) one and a Half to the *Freeze* (F 5) and two and a Half to the *Cornice*, (g 5) making the Projection of the *Architrave* two Sevenths of its Height, and that of the *Cornice* equal to its Height.—The Height of the *Pedestal* being divided into seven Parts, they give two to the *Base* and *Plinth*, four to the *Dye*, and one to the *Cap*.

They diminish the Column as in the last Order, and dividing the Diameter at Bottom, into five, they make the *Base* of the Column project on each Side, one of these Parts, which gives the Breadth of the *Dye* of the *Pedestal*.—To the *Base* of the *Pedestal* they give one Third of the two Parts for the *Base* and *Plinth*, and make the Projection thereof equal to the Height, and that of the *Cap*, four Fifths of the Height.

They make the Height of the *Base* of the Column, half a Diameter, and its Projection one Fifth of the whole Diameter.—For the particular Members of the *Pedestal*, they divide the Height of the *Base* into four Parts, one for the *Torus*, one Third of a Part for the *Fillet*, one and two Thirds for the *Cymatium*, and the other Part, which is one Third, to the *Astragal* and *Fillet*; the whole Projection being equal to the Height.—The Height of the *Cap* they divide into five Parts, one for the *Astragal* and *Fillet*, which is one Third, two more to the *Cymatium* and *Fillet*, which is half a Part, one to the *Corona*, and one to the *Ogee* and *Fillet*, which is one Third; making the whole Projection four of the said Parts.

The Height of the *Base* of the Column being divided into six, they give one and three Fourths to the *Plinth*, one to the lower *Torus*, one Fourth to the *Fillet*, half a Part to the *Scotia*, one to the *Astragal* and *Fillet* (which are subdivided into six, each *Fillet* having one, and each *Astragal* two) then give half a Part to the other *Scotia*, one Fourth to the *Fillet*, and the remaining three Fourths to the upper *Torus*; as to the *Fillet* above, which is Part of the Column, it is half a Part, or double the Bigness of the under one.

They make the Height of the *Composite Capital* a Diameter and one Sixth, which they divide into seven, giving two to each Height of *Leaves*, the *Head* thereof turning down half a Part; two Thirds of a Part to the Space between the *Leaves* and *Fillet*, one Third to the *Astragal* and *Fillet*, (which is one Third of that) two Thirds more to the *Ovolo*, one Third to the Space between the *Ovolo* and *Abacus*, half a Part to the *Hollow*, and half a Part to the *Ovolo* and *Fillet*, which is one Third thereof.—They make no other Difference between the Projection of this, and that of the *Corinthian*, but in the *Volutes*, which they make after the same Manner of the *Ionick*; making besides, this *Capital* equal in Height to the *Architrave* and *Freeze* taken together.

For to form the *Entablature*, they divide its Height into six Parts, two for the *Architrave*, one and a Half for the *Freeze*, and two and a Half for the *Cornice*.—For the particular Members, the *Architrave* is divided into seven Parts, giving two to the first *Fascia*, half a Part to the *Ogee*, two and a Half to the second *Fascia*; dividing again the upper two Parts into five, half a Part for the *Bead*, one and a Half for the *Ovolo*, two for the *Hollow*, and one for the *Fillet*; making the Projection two of those seven Parts in Height.

They observe no other Order in the *Freeze*, than that followed in the *Ionick*; but they divide the Height of the *Cornice*, into two and a Half princi-

pal Parts, subdividing each of them into four, and the Half into two, which makes ten in the whole; giving one Fourth to the *Fillet*, one Fourth to the *Bead*, and one to the *Ogee*, one more to the first *Fascia* of the *Modillions*, half a Part to the *Ogee*, one and one Fourth to the second *Fascia*, one Fourth to the *Fillet*, half a Part to the *Ovolo*, two to the *Corona*, one to the *Scima reversa* and *Fillet*, which is one Fourth, and one and a Half to the *Scima recta*, and half a Part to the *Fillet*; making its whole Projection equal to its Height.

The *Composite* is also called the *Roman* and *Italick Order*, as having been invented by the *Romans*, conformably to the rest, which are denominated from the People among whom they had their Rise.—Mr. *Perrault*, in his *Vitruvius*, distinguishes between *Composite* and *composed Order*.—The latter, he says, denotes any Composition whose Parts and Ornaments are extraordinary and unusual; but have withal somewhat of Beauty; both on Account of their Novelty, and in Respect of the Manner or *Genius* of the *Architect*; so that a composed Order is an arbitrary humorous Composition, whether regular or irregular.—The same Author adds, that the *Corinthian Order* is the first *Composite Order*, as being composed of the *Dorick* and *Ionick*, which is the Observation of *Vitruvius* himself, *Lib. 4. c. 1.*

Before I conclude this Treatise of *Architecture*, it will not be improper to take Notice here, of the several general Rules given by *Palladio*, in order to avoid several Errors which were first introduced by the *Barbarians*, and which are still in Practice among us.

1. He would have us admit of nothing in the several Orders repugnant to that Symmetry, which Nature observes in all her Works; and whereas, for Instance, Trees are bigger at the Trunks and near the Roots than at the Top, consequently he would have it laid down as an infallible Rule, that Columns should be thicker at Bottom than at Top.

2. He rejects all Columns without *Bases*, since *Bases* with their *Torus's* and *Cavetto's* represent so naturally the Swellings occasioned by the Weight they sustain, therefore condemns those who deviating from whatever is good, just and beautiful in *Architecture*, instead of *Pilasters* or Columns, which are to sustain any Weight, place *Cartouches*, which he calls *Scrolls*, and supposes should strike the Eyes of Judges very disagreeably; and are so far, says he, from being satisfactory and pleasant to those, who are not, that they give them only an imperfect Idea of *Architecture*, and only put Builders to an unnecessary Expence; for which Reason he would have none of those *Cartouches* come out of the *Cornice*.

3. He condemns all *Frontispieces* of Gates, Windows, and Galleries, divided, and open in the Middle, since those *Frontispieces* were first made to defend these Parts of the Edifice from Rain, &c. Necessity having instructed the antient *Architects* to cover them, and to give them the Shape of a Roof.—Therefore he thinks that nothing can be more ridiculous than to open that Part which was invented for no other purpose than to shelter the Inhabitants, and such as go into it from Rain, Snow, Hail, and other Injuries of the Weather. And, says he, tho' Variety and Novelty pleases all Mankind, yet they are not to be introduced in direct Opposition to the Rules of Art, and the Dictates of Reason; and it must be acknowledged, that the Antients never departed from any general and necessary Precepts of Art in their various Inventions.

4. He forbids the making the Projecture of the *Cornice*, and other Decorations very large, because when they exceed reasonable and due Proportion, especially in a close Place, they make it still closer, and more disagreeable to the Eye, and frighten those who stand under them, who imagine they are every Moment to fall on their Heads.

5. He will have the *Cornice* made in a due Proportion to the Columns, for if great Cornices are put over

over little Columns, or little Cornices upon great Columns, the whole must needs be disagreeable to the Eye.

5. He advises us to avoid the supposing the Columns to be composed of various Pieces, and jointed together by certain *Annulets*, and Garlands round them, which appear to keep them close together; because the more solid and whole the Columns seem to the Eye, the better they answer the End, for which they were raised, which is to make the whole Building more strong and secure.

6. And he forewarns us against making some *Members* in the *Cornice* unequal to the Rest, besides several other Abuses, which he supposes an able Architect can caution himself against.

There are other Sorts of *Architecture*, as *Architecture in Perspective*, which is a Sort of Building, wherein the Members are of different Measures and Modules, and diminish in Proportion to their Distance, to make the Work appear larger, and longer, to the View, than really it is. Such is the celebrated Pontifical Stair-Case of the *Vatican*, built under Pope *Alexander VII.* by *Cavalier Bonino*.

COUNTERFEIT ARCHITECTURE, which is that which has its Projectures painted, either in black or white, or coloured after the Manner of Marble, as is seen practised in Frontispieces and Palaces in *Italy*, and in the Pavilions of *Marly*.—This Painting is done in *Fresco* upon plaister'd Walls, and in Oil on Walls of Stone.—Under the Name of *Counterfeit Architecture*, which we, otherwise, call *Scene-Work*, is likewise comprehended, that painted on slight Boards, or Planks, of Wood, whereon the Columns, Pilasters, and other Parts of Building seem to stand out, with a *Relievo*; the whole being coloured in Imitation of various Marbles, Metals, &c. and serving in the Decorations of Theatres, Triumphal Arches, Publick Entries, Funeral Poms, &c.—Such is the *Catafaleo*, used for a Decoration of *Architecture*, Sculpture, and Painting; raised on a Timber Scaffold to shew a Coffin or Tomb in a funeral Solemnity.

Architecture is scarce inferior to any of the Arts in Point of Antiquity.—Nature and Antiquity taught the first Inhabitants of the Earth to build themselves Huts, Tents, and Cottages; from which, in Course of Time, they gradually advanced to more regular and stately Habitations, with Variety of Ornaments. *Moses* was not so kind to inform us what Kind of Habitations had the *Antediluvians*; if they had any fixed ones, or if they only dwelt in Tents, as the *Tartars* do; moving from Place to Place, as the Circumstances of the Times, the Climates, and the Seasons required it; if so, the *Ubiquarians* can very well trace their Origin as far as those dark Times, which we know nothing of but by Supposition, and meer Conjectures, and challenge the Free-Masons for Antiquity; if not, and they had really fixed Habitations, Mest. the *Ubiquarians*, must give the Precedency to the Free-Masons; though after a more mature Consideration, we are all nothing else but *Ubiquarians*, since we cannot flatter ourselves with having a permanent Mansion here on Earth; a Tempest, an Earthquake, the Fire, and an infinite Number of other unforeseen Accidents, can ruin and destroy from its Foundation, the strongest and best built Edifice; and the Craft of a Lawyer, dislodge us from our Houses, and render us *Ubiquarians*; therefore that honourable Society has in Fact a far greater Number of *Members*, than those that meet in their several *Conventions*, among whom they may reckon several Kings and other Princes, and even at present they are honoured with the Fellowship of *Stanislaus*, King of *Poland*, of *Ragotski*, Prince of *Transylvania*, and of the Duke of *H———n G———p*, an Honour which the *Free-Masons* can scarcely boast of.

Vitruvius contends for the Origin of *Architecture*, being almost as antient as human Society, and that the Rigour of the Seasons first led Men to make little Cabins to retire into; at first Half under Ground, and

the Half above covered with Stubble; at length, growing more expert, they planted Trunks of Trees at end, laying others a-cross, to sustain the Covering.

But, however, as I don't suppose those first Architects to have been very curious in the Symmetry of their Edifices, or observed any regular Order, I'll rather believe, with some of the antient Writers, that *Architecture* first began to be reduced to any tolerable Order among the *Tyrians*; that *Villalpandus* asserts that *Solomon* was the first who brought it under those Rules, which he had received from God himself (whence he supposes *Architecture* of divine Invention) and that the *Tyrians*, employed by that Prince, had learned that Art from him, and carried it afterward into their Country. To what a Pitch of Magnificence and Grandeur the *Tyrians* carried it ere it came to the *Greeks*, may be learned from *Ishaiab xxiii. 8* yet in the common Account *Architecture* should be almost wholly of *Grecian* Original: Three of the regular Orders, or Manners of Building, are denominated from them, viz. *Corinthian*, *Dorick*, and *Ionick*, and scarce a Part, a single Member or Moulding but comes to us with a *Greek* Name.

Be that as it will, it is certain the *Romans*, from whom we derive it, borrowed what they had entirely from the *Greeks*; nor seem, 'till then, to have had any other Notion of the Grandeur and Beauty of Buildings, besides what arises from their Magnitude, Strength, &c. Thus far they were unacquainted with any Order but the *Tuscan*. Under *Augustus Architecture* arrived at its Glory: *Tiberius* neglected it as well as the other polite Arts. *Nero*, amongst a Heap of horrible Vices, still retained an uncommon Passion for Buildings, but Luxury and Dissoluteness had a greater Share in it than true Magnificence. *Apollodorus* excelled in *Architecture* under the Emperor *Trajan*, by which he merited the Favour of that Prince, and it was he who rais'd the famous *Trajan's Column*, subsisting to this Day. After this, *Architecture* began to dwindle, and though the Care and Magnificence of *Alexander Severus* supported it for some Time, yet it fell with the *Western Empire*, and sunk into a Corruption, from whence it was not recovered for the Space of twelve Centuries.

The Ravages of the *Visigoths* in the fifth Century destroyed all the most beautiful Monuments of Antiquity; and *Architecture* thence forwards became so coarse and artless, that their professed Architects understood nothing at all of their Design, wherein its whole Beauty consists: Hence a new Manner of Building took its Rise, called the *Gothick*.

Charlemagne did his utmost to restore *Architecture*; and the *French* applied themselves to it with Success, under the Encouragement of *H. Capet*, the first of the Line of the *Capetians*, from whom the present King of *France* is lineally descended. His Son *Robert* succeeded him in this Design, 'till by Degrees the modern *Architecture* was run into as great an Excess of Delicacy, as the *Gothick* had before done into Massiveness. To this may be added the *Arabesque*, *Morish*, or *Morisk Architecture*, which were most of a Piece with the *Gothick*, only brought in from the South by the *Moors* and *Saracens*, as the former was from the North by the *Goths* and *Vandals*.

The Architects of the thirteenth, fourteenth and fifteenth Century, who had some Knowledge of Sculpture, seem to make Perfection consist altogether in the Delicacy and Multitude of Ornaments, which they bestowed on their Buildings, with a World of Care and Sollicitude, though frequently without any Conduct or Taste.

In the two last Centuries, the Architects of *Italy* and *France* were wholly bent upon retrieving the primitive Simplicity and Beauty of antient *Architecture*, in which they did not fail of Success; in-so-much that our Churches, Palaces, &c. are now wholly built after the *Antique*.

The most celebrated Architects are *Vitruvius*, *Palladio*,

Radio, Scamozzi, Serlio, Vignola, Barbaro, Cataneo, Alberti, Viola, Inigo Jones, Mansard, Bullant, and De Lorme.

We have no Greek Authors extant on *Architecture*. The first who wrote of it was *Agatharbus* the *Athenian*, who was seconded by *Democritus* and *Theophrastus*. Among the *Latins* *Fuffius, Terentius Varro, Publius Septimius, Rufus, and Epaphroditus* wrote *De Re Architectonica*. But of all the Antients *Vitruvius* is the only entire Author; though *Vegetius* relates that there were 700 Architects at *Rome* in his Time. He lived under *Augustus*, and composed a compleat System of *Architecture* in ten Books, which he dedicated to that Prince. There are two Things censured by the Moderns in this excellent Work, *viz.* Want of Method, and Obscurity. The Mixture of *Latin* and *Greek* in *Vitruvius* is such, that *Leon Baptista Alberti* has observed he wrote *Latin* to the *Greeks*, and *Greek* to the *Latins*: He adds that the Work contains Abundance of Things superfluous and foreign to the Purpose. For this Reason *M. Perrault* has extracted all the Rules out of *Vitruvius's* prolix Work, methodised, and published them in a little Abridgment. Several Authors have also endeavoured to explain the Text of *Vitruvius*, particularly *Philander, Barbaro, and Salmosius*, in Notes added to their several Editions; *Rivius* and *Perrault* in the Notes to their *German* and *French* Versions; and *Baldus* in his *Lexicon Vitruvianum*, enlarged by *De Laet*. The same *M. Perrault*, has also composed an excellent *Treatise of the five Orders*, which may be esteemed a Supplement to *Vitruvius*, who left the Doctrine of the five Orders defective.

The Authors upon *Architecture* since *Vitruvius* are, *Leon Baptista Alberti*, who in 1512 published ten Books of the Art of Building in *Latin*, designed to outvie *Vitruvius*; in which however he has not succeeded; his Work has Abundance of good Things, but is deficient in the Doctrine of the Orders. *Seb. Serlio*, who wrote seven Books of *Architecture*, five of which, concerning the five Orders, were made publick in 1602; throughout all which, he religiously keeps to *Vitruvius's* Rules: The seventh was since published in 1675; but the sixth, concerning private Buildings, has not yet appeared. And *Palladio*, who wrote four Books of *Architecture*, containing the fundamental Rules of the Art, with various Instances of all the Kinds of Works, published in *Italian* in 1575: The two first Books are rendered into *High Dutch*, and enlarged with Annotations by *Boeckler*; and the four published in *English* in 1735, embellished with a large Variety of Chimney-Pieces, collected from the Works of *Inigo Jones* and others. *Phil. De Lorme*, who published nine Books of *Architecture* in *French*. *J. Barozzi De Vignola*, who in 1631 made Publick his Rules of the five Orders in *Italian*, since translated with large Additions by *Daviler*, under the Title of *Cours D'Architecture, &c.* and since also into *High Dutch* with Notes.

To these are to be added *Vincent Scamozzi*, his Idea of universal *Architecture*, published in 1615 in *Italian*; *Car. Phil. Dieussart*, in his *Theatre of Civil Architecture*, published in *High Dutch* in 1697; wherein he not only delivers the Rules of *Architecture*, but explains and compares the five Orders, as laid down by *Palladio, Vignola, Scamozzi, &c.* which same Design was also executed in *French* by *R. Freart De Cambray*, in a *Parallel of the antient Architecture with the modern*, published in *French* in 1650, and since translated into *English*, with Additions by *Mr. Evelyn*. *Fr. Blondel*, Director of the Royal Academy of Painting, &c. in 1698, gave a *Course of Architecture* in *French*, being a Collection from all the celebrated Writers upon the Subject of the Orders, &c. *Nic. Goldman* in a *Treatise De Stylometris*, published in *Latin* and *High Dutch*, in the Year 1661, has done good Service by reducing the Rules and Orders of *Architecture* to a further Degree of Perfection, and shewing how they may be easily delineated, by means of certain Instruments invented by him.

Lastly, the *Elements of Architecture* are very ingeniously laid down by *Sir H. Wotton*. The same are reduced by *Starmius* and *Wolfius*, to certain Rules and Demonstrations; and thus is *Architecture* brought into the Form of a Mathematical Art; by the first, in his *Mathesis Juvenil*, and the second in his *Elementa Matheseos*, Tom. 2. An. 1715.

We have not forgot, but forbore to avoid a certain Confusion, mentioning, among the five Orders of *Architecture*, some other Orders, which no Author has judged proper to intermix with those principal ones, as the *Rustick, Attick, Persian, Caryatick, Gothick, French, and Spanish* Orders.

The *RUSTICK ORDER*, is that adorned with *Rustick* Quoins, Bossages, &c.

The *ATTICK ORDER*, is a little Order of low Pilasters, with an *Architrave Cornice* for its *Entablature*, as that of the Castle of *Versailles*, over the *Ionick*, on the Side of the Garden. *M. Blondel* calls the little Pilasters of *Atticks* and *Mezzanines* false Orders.

The *PERSIAN ORDER*, is that which has Figures of *Persian* Slaves instead of Columns to support the *Entablature*. This Order was first practised among the *Athenians*, on Occasion of a Victory their General *Pausanias* obtained over the *Persians*; as a Trophy of this Victory, the Figures of Men dressed in the *Persian* Mode, with their Hands bound before them, and other Characters of Slavery, were charged with the Weight of *Dorick* Entablatures; and made to do the Office of *Dorick* Columns.—Though *M. Le Clerc* observes that *Persian* Columns are not always made with the Marks of Slavery; but are frequently used as Symbols of Virtues, Vices; of Joy, Strength, Valour, &c. as when made in the Figures of *Hercules*, to represent Strength, of *Mars, Mercury, Faunus, Satyrs, &c.*

The *CARYATICK ORDER*, is that, whose *Entablature* is supported with Figures of Women, instead of Columns.—*Vitruvius* observes, that the *Greeks* having taken the City *Carya*, led away their Women Captives; and to perpetuate their Servitude, represented them in their Buildings, as charged with Burdens, such as those supported by Columns.—The *Caryatides*, says *M. Le Clerc*, are not now represented as among the Antients, *viz.* as Symbols of Slavery, with Hands tied before and behind; those Characters being supposed Injurious to the fair Sex. Among us they are represented as Images of Justice, Prudence, Temperance, &c.—Their Legs are always to be close to each other, and even a-cross; their Arms laid Flat to the Body, or to the Head, or at least as little spread as possible; that, as they do the Office of Columns, they may have, as near as possible, the Figure thereof. Sometimes their Arms are cut off for greater Delicacy; as in the Hall of the *Swiss* Guards in the *Louvre*; but *M. Le Clerc* does not approve of such Mutilations.

When insulated they should never have any great Weight to support; and their *Entablature* and *Pedestal* are ordinarily to be *Ionick*.—When they join to a Wall, &c. it is adviseable to put a *Console* over them, which may appear to support the Weight of their *Entablature*; otherwise as they represent Women, they do not seem so proper to sustain great Loads.—When they are made in Form of Angels, the same Author would have them support the *Entablature*, which in that Case, is to be *Corinthian*, with their Hands.—The Antients made the *Caryatides* frequently to support Baskets, or *Corbels* of Flowers; and these they call *Canephoræ*, or *Cistiferæ*; which *Canephoræ*, are in Allusion to the *Canephoræ* of the Antients, which were two Virgins of *Athens*, kept in *Minerva's* Temple in the *Acropolis*, who at the Feast of the *Panathenæa*, carried Baskets on their Heads, with something secret or mysterious therein, delivered to them by the Priestesses.—The Baskets were usually crowned with Flowers, Myrtles, &c.—The *Canephoræ*, in these Ceremonies, always marched first, the Philosopher or Priest next, and the Choir of Music followed.

FRENCH ORDER, is a new contrived Order, where-in the Capital consists of Attributes agreeing to that warlike Nation; as Cocks Heads, *Flower-de-Luces*, &c.—Its Proportions are *Corinthian*; such is that of M. *Le Brun*, in the grand Gallery of *Versailles*; and that of M. *Le Clerc*. This last gives us a second *Tuscan Order*, and a *Spanish Order*, besides his *French Order*.—The *Tuscan* he ranks between the first *Tuscan* and *Dorick*.—Its Height he makes 23 Semi-diameters, 22 Minutes.—The *Column* to have 15, the *Pedestal* 5, and the *Entablature* 3, and 22 Minutes; and he proposes its *Freeze* to be adorned with *Turtles*,

which are the Arms of *Tuscany*.

The SPANISH ORDER he places between the *Corinthian*, and *Composite*.—The whole Order he makes 30 Semi-diameters, 28 Minutes, whereof the *Column* has 9, and 25 Minutes, the *Pedestal* 16, and 18 Minutes, and the *Entablature* 4, and 15 Minutes.—The Horns of the *Abacus* he sustains with little *Volutes*; the Middle, in lieu of a *Rose*, has a *Lion's Snout*; That Animal being the Symbol of *Spain*, and expressing the Strength, Gravity and Prudence of that Nation.

A R I A N I S M.

ARIANISM is an antient Heresy in the Church, broached in the Beginning of the fourth Century, by *Arius*, Presbyter of *Alexandria*; whence his Disciples and Partisans have been called *Arians*.

Arius was born in *Africa*, in that Part of *Lybia* which confines with *Egypt*. *Arius* had a great deal of Pride and Ambition hidden under a bright Genius, vast Knowledge, and profound Understanding, which recommended him to *Peter*, Patriarch of *Alexandria*, who ordained him *Deacon*; and finding afterwards, that *Arius's* Merit was not supported with that Piety, Virtue, and Orthodoxy he expected to find in him, but that on the contrary, soon after his Ordination, he had declared himself a Partisan of *Meletius*, the Schismatick Bishop of *Lycopolis* in *Thebaida*, he was excommunicated as a *Relapse* by the Patriarch, who being obliged soon after to seal his Faith with his Blood; *Arius* by his Artifices having found the Secret to ingratiate himself with *Achillas*, *Peter's* Successor in the See of *Alexandria*; this new Patriarch not only received him into his Communion, but likewise raised him to the first Dignities of the Church, next to Episcopacy; for he not only ordained *Arius* Presbyter, but gave him also the Government of one of the principal Churches of *Alexandria*, (of one of those called *Laura's*) and according to *Theodoret l. 1. c. 2.* made him Professor of Divinity, or *Theologal* of the Cathedral Church.

The great Reputation *Arius* acquired in these two eminent Posts or Employments, flattered his extreme Vanity with the Hope of being chose to succeed *Achillas*; but was frustrated in his Expectation by *Alexander*, a Person of an extraordinary Merit, whose rare Virtues, exemplary Life, and the signal Services he had done to the *Eastern* Church, had gained the Suffrages of the Christians of *Alexandria*, being raised to the patriarchal Chair, at *Achillas's* Demise, who had held it but a short Time.

The new Patriarch's principal Care after his Elevation, was to gain *Arius's* Friendship, by giving him at all Times and in all Occasions, repeated Marks of his Esteem, but all to no Purpose; for *Arius*, from the first Moment of his disappointed Ambition, had formed the Design of being revenged on the Patriarch, for the Injustice, he pretended, the People of *Alexandria* had done to his Merit, by preferring *Alexander* to him, in the *Patriarchate*. And as he found it was impossible to censure the Life of his Patriarch, which was irreproachable, he hoped to ruin his Credit, by rendering him suspected of Heresy, and was almost sure of Success, knowing himself to be a very subtle Logician, and consequently capable to puzzle, in disputing, the Christians of those Times, not at all acquainted with the Subtilties of the *Platonician* or *Aristotelian* Schools.

An Occasion soon offered itself, which favoured *Arius's* ambitious and criminal Design; for the Church enjoying at that Time a profound Tranquillity, and the Patriarch *Alexander* being determined to apply himself wholly to the Instruction and Conduct of that Portion of *Christ's* Flock committed to his pa-

ternal Care, used to instruct his Clergy in publick Conferences, where he expounded with a great deal of Penetration, Knowledge and Sagacity, the principal Articles of the Doctrine of the Church.—Therefore having one Day assembled all the Priests of *Alexandria*, he began to talk in a very sublime Manner, on one of the most profound and most incomprehensible of our Mysteries, shewing the indivisible Unity which subsisted in the Trinity, who were three distinct Persons, though all three had but the same Essence.—'Twas then, says *Theodoret, l. 1. c. 2.* that *Arius* thought he could never have a better Opportunity to attack his Patriarch with Advantage. For as the Heresy of *Sabellius* was abhorred and detested by the whole oriental Church, who sixty Years before had had the sacrilegious Presumption to advance, that there was but one Person in God, under three different Names, and with three different Operations; *Arius* stood up in the Middle of the Assembly, and with a great deal of Warmth and seeming Zeal, pretended that the Patriarch had advanced *Sabellius's* Dogma, only disguised under another Expression; and that it was impossible to maintain such Unity of Essence, without confounding the Persons together; that the Son could not have been begotten without having the Father for his first Principle, whence he concluded with philosophical Reasonings, that that Principle must have been before him; and therefore the Son could not have such Unity of Substance with the Father.—The whole Assembly was surpris'd at *Arius's* Presumption, which however, sowed the first Seeds of Division among them; for as *Arius* was esteemed a Person of a profound Erudition, very well versed in the Scriptures, that he appeared as if he would only oppose the Errors of *Sabellius*, and that he spoke then very pertinently, and with much Subtily on the Subject, at that very Time, some of the Assembly espoused his Party; though the greatest Number stood by their Patriarch, and maintained his Doctrine, as one of the most essential Points of the Christian Religion.

Alexander, who observed that the Spirits on both Sides, had been over-heated by the Disputes, thought that the best and easier Expedient, was to endeavour to procure a Reconciliation among them, by all the Means his easy and truly christian Temper could dictate him; therefore, without having Recourse to those violent Expedients he could have employ'd to force them to submit themselves to his Authority; he had Priests selected out of both Parties to propose and defend their respective Opinion, where says *Sozomen lib. 1. c. 14.* he would set, with the Chiefs of his Clergy, as Judge, to decide, by a solemn Judgment, their Differences; he went even so far, the better to convince both Parties, that he acted without Prejudice or Partiality, as to appear indifferent as to the two Opinions, praising sometimes the one, and sometimes the other, according to the different Turn the Dispute took; but he soon perceived that too great a Complaisance, especially in religious Matters, weakens

weakens as much the Party of the Truth, as it renders the adverse Party strong and audacious; for *Arius* abandoning himself, to the Violence and Impetuosity of the Desire he had to conquer his Opponents, endeavoured to support his first Blasphemy, with so scandalous and detestable Propositions, that to have heard him much longer, had been, in some Measure, to have rendered oneself his Accomplice.

Sozomen, *Theodoret*, and *St. Athanasius*, say, that *Arius* in that Conference, to maintain that the Son is not of the same Substance with the Father, went so far as to advance, that, properly speaking, the Father was sole God, sole Eternal, sole Wise, sole Good, sole Omnipotent of himself, and sole Immutable; that he was God from all Eternity, and Father only since he had begotten his Son, or his exterior Word, who did not proceed from his Substance; that by his Wisdom and interior Word he had formed and created him from nothing, before the other Things created; that the Father was before the Son, when the Son had no Existence yet; having created him to form all the other Creatures by him, which he surpassed in Excellency; so that he was really the *Son of God*, and God himself by Participation, superior to all the Angels and Men, but of a Nature inferior to that of his Father, which of itself was capable of *Mutation*, and of passing from Good to Evil, and from Virtue to Vice, if the Father had not freed him of that Change, by having foreseen from all Eternity, that he would be constant in doing good.

This is, says *Athanasius* and *Sozomen*, what *Arius* maintained in this Conference or Disputation of *Alexandria*, and the whole Foundation of *Arianism*; in which his Disciples have often changed several Things, as the several Conjectures and Circumstances of Time obliged them to it.

Alexander, surprized at these fatal Consequences he had not foreseen, put an End to the Controversy, by pronouncing in favour of those who had defended the Divinity and Eternity of the Son of God; forbidding *Arius* to preach, or divulge his false Dogma, which tended towards the entire Ruin, of the first and best established Principles of the Christian Religion.—*Arius*, who saw that in a short Time he would be capable to form to himself a strong Party, which the Patriarch could scarce be able to oppose, thought proper to dissemble his Resentments, and have more Time to prepare all his Machines against his Enemies, as he did.—He began by those who had declared openly for him in the Conference, whom he easily confirmed in his Party, by representing to them the Dishonour and Shame of recanting when once one has espoused an Opinion.—Of the other three chief Priests who governed the Parishes of *Alexandria*, and who had already began to preach other Errors, he gained two, *Carponas* and *Sarmatas*; who finding that they had neither Credit nor Partisans enough, to make themselves Chiefs of a Party, acknowledged *Arius* for theirs.—As for the Third, call'd *Colluthus*, by *Epiphanius*, *Ilres*. 69. he made an Heresy apart, which not being supported with all the Spirit, and Artifices, capable to form an *Heresiarch*, was soon extinct.

Socrates, *l. 4. c. 3.* informs us, that *Arius* found himself soon strengthened, by near twenty Ecclesiasticks, of those who had the Reputation of being the greatest Wits, and the most learned; and of two famous Bishops, *Secundus* of *Ptolemaides* in the *Pentapole*, and of *Theonas* of *Marnarie* in *Lybia*; on which he began to think, he could act more openly, and employ all the Talents he had received from Nature, to gain Profelytes; for he had in fact the Advantages necessary to captivate the Minds and Hearts of his Auditors; he was tall of Stature, very well shaped, and of so grave and serious an Aspect, that one could have been easily persuaded, that he was a Person of an extraordinary Virtue and Piety, and of a very austere Life; to which may be added, his modest and decent Dress, his easy Access, accompanied with all the Affability and good Manners, which he

employed with a great deal of Dexterity, to persuade those whom he wanted to engage in his Party.

Such as I have represented him, and believing himself strong enough, says *Theodoret*, *l. 1. c. 2.* to act with more Liberty, he began to preach his Doctrine in his own Church; where it was easily received by those, who used to hear him as an Oracle. He explained it in private Conferences, and in his Conversations, and used to go from House to House, to debauch, if possible, the Chiefs of the City, and especially those of the fair Sex, who were the most esteemed and respected for their Piety and Virtue; over whom he had soon gained a very great Ascendant, by his devout and insinuating Air.—At last, he made, by his Intrigues, so great a Progress, that if we believe *Epiphanius*, he found the Secret to seduce, among the rest, very near seven hundred Virgins, and devout Maids, of those who had consecrated themselves to God, in *Alexandria*, who all put themselves under his Conduct, and adhered so obstinately to his Errors, that they afterwards persisted in them, notwithstanding all the Efforts, and other efficacious Means employed to undeceive them.

That could not be done, says *Theodoret*, without an *Ecclat*, which awaken'd at last the Patriarch as from a profound Sleep, he had abandoned himself to, thro' an Excess of his natural Goodness, and the Artifices and affected Submissions, of him who only wanted to deceive him.—*Alexander* then sent for *Arius*, and having charitably reprimanded him, and reproached him, in soft Terms, with his Disobedience, and the Scandal he caused in the Church by his Blasphemies, against the sacred Person of *Jesus Christ*, he commanded him to retract: But *Arius*, puffed up with his new Conquests, (believing himself strong enough, not only to stand on the defensive, but even to attack if he could find an Opportunity of doing it to Advantage) answered impudently, and with Arrogancy, That what he had advanced was nothing but the pure and orthodox Truth; and if one of the two was obliged to a Recantation, it was he the Patriarch, who had infected his Flock with the Heresy of *Sabellius*.

Alexander finding that his Lenitives, instead of curing the Wound, served on the contrary to render it more desperate, was forced at last to have Recourse to more violent Remedies.—He convoked in *Alexandria* a Council of a hundred Bishops of the Provinces of *Egypt*, and of *Lybia*; wherein the Case having been impartially and exactly discussed; the impious Doctrine of *Arius* was condemned; and as he refused always with the same Obstinacy to abjure his Errors, he was solemnly degraded, excommunicated, and expelled with his Followers, both from the Church and the City.

The Council being thus ended, *Alexander* judged proper to inform the other Bishops, who had not been present, of the Condemnation of *Arius*; which he did by a circular Letter, which for the Description he made therein, of the Origin and Progress of *Arianism*, which has so great a Report, to the other Heresies which have been broached since in the Christian Church, I will insert here Word for Word as related by *Socrates*.

Note, That the Reader must not mistake this *Socrates* for the Philosopher *Socrates*, since this was a Christian, born under the Empire of *Theodosius*, and who has wrote the History of the Church of those Times.

A Letter of Alexander Bishop of Alexandria.

To our dearly-beloved and worthy Colleagues in the Ministry of the Catholick Church, Alexander, Greeting in the Lord.

Whereas the Catholick Church makes up but one Body; and we are ordered in the sacred Scripture, to preserve it with Care, Peace, and Unanimity among us; it is just we should inform one another reciprocally, of what happens in our

our respective Diocesses, so that if one of the Members be in Affliction, or in Prosperity, the others may condole, or rejoice with him. Perverse Men, and Enemies of our Lord, have risen lately in our Diocese, teaching how to separate one-self by Schism, which is a Disposition against the Arrival of the *Antichrist*. I thought at first to have been capable to bury that Disorder in Oblivion, and that having smothered it in the Persons of those *Apostates*, it would spread no further, to the Abuse of the too great Credulity of the Simple and Ignorant. But since *Eusebius*, who, to usurp the See of *Nicomedy*, has deserted that of *Beryle*, has took those *Apostates* under his Protection, and has wrote every where in their Favour, I must break the Silence, to inform you of this new Error, and to precaution you against all that *Eusebius* could write to you on that Subject. — On this Occasion, he renews his antient Magnity and Spite, which seemed to have been defaced by Time; and though he seemingly writes in favour of those *Apostates*, he nevertheless consults his own Interest. — However, these are the Names of those who have separated themselves from the Church; *Arius*, *Ambillas*, *Aitbales*, *Carpones*, another *Arius*, *Sarmates*, *Eurouis*, *Lucius*, *Julien*, *Menas*, *Helladius*, *Gaius*, and likewise *Secundus* and *Theonas*, who formerly were called Bishops.

They advance with the greatest Temerity, but without being authorised therein by the Scripture, that God has not been always *Father*, but there has been a Time when he was not so. That the Word of God has not always been, but was created from nothing; God who is, having created him who was not, from what was not; since the Son is the Creature and the Work of his Father, who is not like unto his Father as to his Substance, nor the true Word of God, nor his true Wisdom, he being but one of his Works, and one of his Creatures; and that it is an Abuse to call him *Word* and *Wisdom*, since he has been created by the Word, and by the Wisdom which are in God, and by which all his other Works have been formed. Hence it follows, that his Nature is subject to Changement, like all the other reasonable Creatures. That the Father is invisible and ineffable to the Son, for the Son does not know him perfectly, nor can see him. — That the Son does not know his own proper Substance, has only been made for us, and as an Instrument of his Father for our Creation, for if God had never form'd the Design of our Creation, the Son had never been. — Some having asked them, if the Word of God could change as the Devil has changed, they have not been ashamed to answer, that he certainly could; for he is of a Nature subject to Changement, since he can be begotten and created. — We having assembled with very near a hundred Bishops, as well from *Egypt* as from *Lybia*, have pronounced *Anathema* against *Arius*, who is the first Promoter of those Errors, and against all his Partizans. But *Eusebius* has received them, endeavouring to mix Impiety with Piety, and Falshood with Truth; but he shall not conquer, since the Truth is always Conqueror, and there can be no Society between Light and Darkness, Christ and the Devil. — Who has ever heard the like! or who could hear it without being surprised with Astonishment, and without stopping his Ears for fear they should be defiled with so much Filth? Where's the Person who hearing St. *John* say, *in the Beginning was the Word*, will not condemn those who pretend, that there has been a Time when he was not? Or who is he, who hearing these Words of the Evangelist, the *only Son*, and *by him all Things have been made*; will not be provoked with Indignation against those who affirm that the *Son* is but a Creature? For if he was but a Creature, how could he be one of those which have been made by him? How could he be the *only begotten Son*, if he was ranked among the Creatures? Since the *Father* says, *my Heart has produced a good*

Word; and again, *I have begotten thee in my Bosom before the Morning Light*. How could he be of a Substance different from that of his *Father*, since he is his most perfect Image, the Splendor of his Glory, and says himself, *he that sees me, sees my Father*? If the *Son* is the *Reason* and the *Wisdom* of the *Father*, how can it be possible, that there has been a Time when he was not? It is as if they were to say, that there has been a Time, when God was without Reason and without Wisdom. How could he be subject to Changement, when he says of himself, *I am in my Father, and my Father is in me*; and again, *my Father and I are but one*; having said before by his Prophet, *seeing that I am, and I do not change*; for though these Words could be understood of the *Father*, they are nevertheless better apply'd to the *Son*, since he has not been changed in becoming a Man, and as St. *Paul* says, *he is the same to Day he was Yesterday, and will be the same for evermore*. But what could persuade them to advance that he has been made for us, since the Apostle assures, that *all Things have been made for him and by him*. The sacrilegious Presumption they have to advance, that the *Father* is not known perfectly by the *Son*, ought to surprise no body; for since they have declared War against *Christ*, they despise the Word, by which 'tis said, *as my Father knew me, I knew my Father*. So if the *Father* knows but imperfectly his *Son*, the *Son* can know but imperfectly his *Father*. If such a Thing cannot be said without Crime and Blasphemy, and if really the *Father* knows perfectly the *Son*, who is his Word; it is clear that the *Son* knows perfectly his *Father*. We convince them often by these Testimonies of the Holy Scriptures; but they change their Language as often as the *Camelion* changes Colours, and verify perfectly these Words, *That when the impious Man is arrived at the Height of his Crimes, he despises every Thing*. There have been Hereticks before them, whose Extravagance was extreme, but in denying the Divinity of the Word, they have justified those Heresies, because they have approached nearer the Impiety of the *Antichrist*. For this Reason, and no other, they have been expelled the Church, and stricken with *Anathema*. 'Tis true, that we are very sensible of their Loss, and it is with the greatest Sorrow we see them reject the Doctrine of the Church, which they had formerly professed. Moreover we are the less surpris'd at it, that we know the same Misfortune happened to *Hymeneus*, to *Philetus*, and to *Judas*, who after having been the Disciples of the Saviour, forsook and betray'd him; besides, we had been foretold their Apostacy, since the Lord had told us, *Matt. c. xxiv. Take heed that no Body seduce you, for many will come in my Name, saying, I am the Christ, and they'll seduce many; do not follow them*. And St. *Paul*, who had been instructed in the School of the Son of God, says, *1 Epist. Tim. c. iv. In Times to come some will forsake the Faith, by following the Spirit of Error, and the Doctrines of the Devil*. The Lord has himself left us this Precept, and having given this Advice by the Mouth of his Apostle, we have had Reason to pronounce *Anathema* against these Men, of whose Impieties we have been Witness, and to declare them cut off from the Body of the Catholick Church. We inform you of it, our dearest Brothers, and the beloved Companions of our Ministry, lest were they to run to you, you should receive them; or lest you should mind *Eusebius's* Letters; for we all who profess to be Christians, are obliged to avoid, as God's Enemies and Corrupters of Souls, those who speak or entertain any Sentiment against Christ; we must not so much as salute them, for Fear we should become Accomplices of their Crimes. We greet all those who are with you; those with us greet you.

This Letter being sent by *Alexander* to all the Cities, served only to increase the Disorder, and excite the

the Dispute among the Bishops. Some approved it by their Signature, and others rejected it. *Eusebius* whom it affected, opposed it more strenuously than any other: He was then in great Credit, because the Emperor lived at *Nicomedia*, of which *Eusebius* was Bishop, and which was the Cause of several Bishops adhering to his Sentiments. He used to write continually, sometimes to *Alexander*, to desire him to renounce all Sorts of Dispute, and to receive *Arius* into his Communion; and sometimes to the other Bishops, to deter them from joining with *Alexander*; which at last filled the Church with Disorder and Confusion; for not only the Bishops were seen to dispute among themselves, with an extraordinary Warmth, but the People were also divided, and would declare for one or the other Party. The Affair was carried to such Extremity, says *Socrates*, that our Religion became at last a Subject of Raillery, and of Pastime for the Pagans on their Theatres.

But however, if *Arius* had been in some Manner disconcerted by the Decision of the Synod of *Alexandria*, he was not at all discouraged; that City being at that Time one of the greatest, and best peopled of all the *East*, he could easily be hidden there, and cabal by himself and his Partisans, in a Manner the more dangerous, because, not being publick, it could not be so easily opposed. In Effect, he made more Profelytes, by those secret and hidden Intrigues, than he had done yet by his Conferences and Sermons. Some presuming they had Capacity enough, to judge of the Merit of the Cause, pretended that *Arius* was in the right; and others adhered to him, according to Custom, only by a pure Love of Novelty, which has always a great many Charms for the Vulgar. Some embraced his Doctrine, purely because it had been condemned by the Patriarch; and some by a Principle of Compassion for those learned Men, (as they used to say) and those Ecclesiasticks of an extraordinary Merit, unjustly persecuted, because it was not the Pleasure of their Adversaries they should be more learned and wise than they were themselves. It even happened that *Meletius* and his Partisans, to strengthen themselves against *Alexander*, whom they hated, though they did not follow the Doctrine of *Arius*, nevertheless favoured him, and declared for him; so that in a short Time he found himself strong enough, as to hope a complete Victory over his Enemy the Patriarch. But as he foresaw it was impossible for him to succeed so well in his Design as he could wish, without engaging a Number of Bishops in his Defence, especially those who had some Credit at Court, he sent the most learned of his Disciples to the neighbouring Bishops, to whom he wrote Letters, full of Artifices and Submissions, exposing to them his pernicious Doctrine in general Terms, which he stiled the Truth contrary to the Dogma of *Sabellius*. He added (says *Euseb. de Constant. l. 2. c. 60*) That if they were to find it Orthodox, he humbly desired them to grant him their Assistance and Protection, against the Violences of *Alexander*; if not, that he was ready to learn from them what they would be pleased to teach him, concerning a Mystery of such Importance. Through these artificial Means, he surprized at first the too great Credulity of several Bishops, who could not see the Venom hidden under the flattering Protestations of a Man, famous and persecuted; who, says *Sozomen*, threw himself, as it were, into their Arms; but he could never have made Choice of a greater and more powerful Protector, than of *Eusebius* of *Nicomedia*, who had found the Secret to insinuate himself into the Confidence of *Constantia*, the Emperor *Constantine's* Sister, and Wife to *Licinius*. That Princess having been gained by the Dexterity and Complaisance of *Eusebius*, had took Care of his Fortune, and to introduce him at Court. This ambitious Bishop, pleased with so favourable an Occasion of making himself the Chief of a formidable Party, who he hoped would follow blindly his Interests, made no Scruple of granting his

Protection to *Arius*; who by his Letters, had earnestly implored it. Therefore he sent him Word to stand firm and unchangeable in his Sentiments, that he might depend upon finding Persons that would protect and support him in so glorious an Enterprize, and that he was going to write in his Favour to the Bishops of *Palestine*, especially to *Eusebius* of *Cæsarea*, one of his most particular and intimate Friends.

Moreover *Alexander* having been informed of the Disorder caused by *Arius's* Cabals in *Alexandria*, *Egypt*, *Thebaides*, and *Lybia*, had him followed so close, that he was forced at last, to fly with some of his Disciples into *Palestine*, where he had fixed the Rendezvous.—He was no sooner arrived, but as well by himself as by his Partisans, whom (says *Sozom. l. 1. c. 14.* and *Theod. l. 1. c. 5.*) he sent every where; he implored the Protection of the Bishops, particularly of those whom *Eusebius* of *Nicomedia* had disposed to receive him: He acted so well, that in a short Time he gained to his Party, *Eusebius* of *Cæsarea*, *Patrophilius* of *Scythopolis*, *Paulinus* of *Tyre*; and many others who had been persuaded to it, as much by the Favour of *Eusebius* of *Nicomedia*, as by the Artifices and Flatteries of *Arius*; who soon after requested them, that they would be pleased to grant him Leave to make Assemblies, where he might publicly teach his new Doctrine.

Those who acted in concert with him, procured a Convocation of as many Bishops as they could assemble; and granted him, in a Sort of Synod, together with their Communion, the Permission he had asked for; ordering him, however, by an Artifice concerted between them, he should neglect nothing to make his Peace with his Bishop, and thereby engage him to receive him into Favour, and restore him to his Functions. On which *Arius* informing his Protector of the Success of his Negotiation, had the Impudence to assure him, that all the Eastern Bishops, maintained his Doctrine, for which *Alexander* had also pronounced against them the same *Anathema*.

Epiphanius and *Theodoret*, say, that he went further; for having settled his Party in *Palestine*, where he preached publicly his Errors; he went to Court on Purpose to take Measures with *Eusebius*, and to act in concert in so favourable a Beginning.—*Eusebius* introduced him to *Constantia* his Protectress (*Constantine's* Sister, and Widow of the Emperor *Licinius*) as a Person of an extraordinary Merit.—*Arius* had no great Difficulty to gain that Princess, already disposed by *Eusebius*, to receive the Venom of his Impiety; and he acted so well his Part, under the Disguise of Hypocrisy and Adulation, that *Constantia* undertook his Defence; so that as the Serpent, to deceive *Adam*, seduced *Eve* first, so likewise this *Heresiarch*, who, according to *St. Epiphanius*, *Heres. 69.* had the Subtlety of a Serpent, the easier to deceive the World, began by corrupting the Faith of the Sister of his Prince and Master. Thus we have seen in all Ages, that as the first Falshood was introduced into the World by a Woman, it has been perpetuated in the Heresies, which are the Sequel thereof, by the Protection granted to it by some Women (Princesses not excepted) who having not Capacity enough to discover the Error, had more than a sufficient Obstinacy and Presumption to maintain it.

Having so happily began, *Eusebius* and *Arius* concluded that they should oblige the Bishops of their Party to throw off the Mask, and declare publicly in their Favour, but with such Circumspection, as could justify their Conduct near *Constantine*, and shew their Enemies in the wrong.—They then judg'd proper, that all those Bishops should write civilly to the Patriarch *Alexander*, in *Arius's* Favour; desiring he should be re-established, since they believed his Doctrine sound and orthodox; they even were of Opinion, that *Arius* and his Disciples should write at the same Time, which they did; but the Patriarch, who knew perfectly well that all those affected Sub-

missions of *Arius* and his Partisans, were nothing else but mere Artifices to deceive him; wrote several circular Letters to all the Bishops of *Phœnicia*, *Palestine*, *Syria*, and *Asia*, wherein he exposes the Errors and Impieties of *Arius*, complaining in particular of *Eusebius* of *Nicomedia*, whom he charges with several Crimes; and of the Bishops who had declared themselves Protectors of this rebellious Priest. He wrote also to Pope *Silvester*, to inform him of what he had done against *Arius*.

Those Letters sent every where, produced various Effects, according to the different Disposition of the Persons who received them. *Eusebius's* Partisans persisting in their former Project, desired *Alexander* to receive those Ecclesiasticks into his Communion, and to renounce a Dispute which was of no Utility to the Church.—Some wrote in general and ambiguous Terms, that they might be always in a Condition to declare themselves on the stronger Side; others without determining any Thing as to *Arius*, said that they had neither received nor rejected him.—Others excused themselves for having admitted him into their Communion, in that they were not perfectly instructed of all that had happened in his Case.

But the greatest Number was on *Alexander's* Side; for several Bishops of all the Provinces of *Africa*, and *Asia*, having received his Letters, rejected *Arius* as an Heretick, and an Excommunicate; and in Answer to the Patriarch, sent him their Confession of Faith agreeable to his, and signed with their own Hands.

The Emperor *Constantine* having conceived a very sensible Displeasure at this Contestation, which prepared Matter of Laughter for the Infidels, and hindered them from embracing the Christian Religion, thought of smothering it in its Infancy; but as he had been misinformed by *Eusebius*, for whom he had a particular Esteem, and who had represented to him the Articles in Dispute, as meer Trifles, not at all essential to the Christian Faith, laying all the Fault on the Patriarch of *Alexandria*; the Emperor wrote to *Alexander* and to *Arius*, blaming them both, and much more the Patriarch than *Arius*, commanding them to make Peace, without contesting any longer on a Subject, which was the Cause of so much Trouble in the Church.—The Emperor sent this Letter (says *Socrat. l. 1. c. 14. Theodoret, l. 1. c. 6. and Sozom. l. 1. c. 15*) by *Osus* Bishop of *Cordua* in *Spain*, who was then at the Emperor's Court, and for whom he had a singular Veneration. *Osus* had rendered himself famous for his rare Virtue, extraordinary Capacity, and for having gloriously confessed the Name of *Jesus Christ* amidst the Torments, during the Persecution of *Dioclesian*.

Constantine soon perceived that he had been imposed upon by *Eusebius*, first in the Letter he received from the Patriarch of *Alexandria*, wherein he assures the Emperor, that the Point in Agitation was not of so trifling a Consequence, as represented to him by *Arius* and his Partisans, since it was one of the most essential of the Christian Religion, even that which distinguishes the *Christians* from the *Jews*, i. e. the Divinity of *Christ*; from whom his imperial Majesty had received so many signal Favours and Victories; and secondly by *Osus*, who being returned to *Constantine*, gave him to understand, that nothing less than a superior Authority and the strongest Remedy, could cure those Evils, and terminate the Differences on a Subject of that Consequence; therefore *Constantine* having carefully examined the Affair, and taken the Advice of the most eminent Prelates, then near his Person, formed the Resolution to have a Convocation of all the Bishops, which could represent the universal Church, to whose Authority both Parties should be obliged to submit.—He did it with the Content of the Pope *Silvester*, who declared *Osus* of *Cordua*, *Vito* and *Vincentius*, Presbyters of the Roman Church, his Legates, to represent him in the future Council.

That grand Affair being resolved upon, *Constantine*

chose *Nice* in *Bythinia* for the Place of that celebrated Assembly; and himself wrote to all the Bishops, to engage them to repair to *Nice* as soon as possible, ordering the Governors of their respective Provinces to defray their Expences upon the Road, taking himself the same Care, while the Council lasted.

What rendered that Assembly the most august and most venerable of all those which were seen in the following Ages, is, that there appeared there the greatest Men, and most famous Bishops of the whole Christian Church; Christian Heroes, who having confessed *Jesus Christ* amidst the Torments of the most cruel Persecution, were come to maintain his Divinity in the Council.—There were seen among the rest, the venerable *Potamius* of *Heraclea* in *Egypt*, who had lost one Eye, during the Persecution of *Maximinus*; *Paphnutius*, one of the first Disciples of St. *Anthony*, and afterwards Bishop of the superior *Thebaides*, who during the same Persecution had been condemned to the Mines, having been first deprived of his right Eye, and one of his Legs, *Paul* of *Neocesarea*, whose Hands had been burnt with red-hot Irons; besides many others, who carried yet on their Bodies the glorious Marks of the Victories they had gained, under the Persecution, over the Enemies of the Christian Name; making in all 318, from all the Churches of *Europe*, *Africa*, and *Asia*.

Eusebius of *Nicomedia* came also there, accompanied with his Partisans, who were but few, in Comparison of the vast Number of orthodox Bishops; for many of those who had adhered to him before the Council, had been afraid to follow him to so august an Assembly; of these the principal were *Eusebius* of *Cæsarea*, *Maris* of *Calcedonia*, and *Theognis* of *Nicea*, who, with him, had denied *Christ* during the Persecution.

Mean while the Emperor came from *Nicomedia* to *Nice*, to honour the Council with his Presence, and to give the necessary Orders; he received all the Bishops with an Affability which was natural to him, and by the extraordinary Respect he shewed them, engaged all his Court to follow his Example. He took Care of their Subsistence, and that they should be lodged commodiously; even ordering that, to give a greater Authority to the Council, all the Assemblies should be held in the imperial Palace; which he would have magnificently furnished for that Purpose; that thereby he might have the Glory and Pleasure of consecrating to *Jesus Christ*, the Majesty of his Empire.—One Thing happened at that Time, which manifested the Greatness of his Soul, the Strength of his Genius, and his Zeal for Religion, which was, that some Bishops having taken this Occasion to present Memorials full of Complaints and Accusations against their Brethren; the Emperor obliged the Accusers to appear before him on a certain Day he had fixed, said he, to do them Justice. Accordingly they all appeared that Day before *Constantine*, who (says *Rufin. l. 1. c. 2.*) having their Libels in his Hand, spoke to them in this Manner, ‘ You must
‘ have a Day fixed, and a Judge to determine your Differences. That Day will be the Day of the universal Judgment, and your Judge *Christ*; as for me
‘ who am but a Man, it don't belong to me to judge
‘ those he has established in his Place as Gods, to
‘ judge us in the most important Affairs, which are
‘ those of Religion. I know it to be your Duty to
‘ behave in such a Manner, as by the Integrity of a
‘ Life agreeable to your Condition, you may be always ready to appear at that Tribunal; but I know
‘ also, that I must have such Respect for your sacred
‘ Character, that if even I was to see any of you
‘ commit a Crime, I should think myself obliged
‘ to cover you with my Purple, to hinder you from
‘ being exposed to the Insults of those who could see
‘ it. Believe me, follow the Example of God, who
‘ is so ready to forgive us our Offences, and having
‘ all but one Soul and one Mind, be united together,
‘ by a perfect and sincere Reconciliation, to treat
‘ seriously

‘ seriously this grand Affair of the Faith, for which you are here assembled.’—At the Conclusion of this Discourse he called God to witness, says *Theodoret* and *Sozomen*, that he had not read a single Word of their Libels, which he had all thrown into the Fire in their Presence, desiring they would all meet the Day fixed for the Opening of the Council.

There was no resisting that Order, which was received by the Bishops, as if spoken by God himself; and those who had made those Complaints, seeing it would be not only in vain, but even dangerous to repeat them, joined with the Rest to begin the Council at the Day fixed, which was the 19th of June, 325.—Seats had been prepared for that Purpose, on the Right and Left of the great Hall, which was in the Middle of the Palace, for the three hundred and eighteen Bishops, and for the Theologians of either Side, who should be called to offer their Reasons.—Every one of the Fathers took his Place according to the Rank of his Church.—The Legates of Pope *Silvester*, who first subscribed to the Council, took also the first Places, together with the Patriarch of *Alexandria*, on the Left Hand (which in all the sacred and ecclesiastical Ceremonies was the most honourable,) opposite to it on the Right, was placed the Patriarch of *Antioch*, with that of *Jerusalem* next, and all the other Bishops in Order on both Sides.—A magnificent Throne had been erected in the Middle of the Hall, on which was placed the Book of the Gospel, as representing *Christ* himself.

Things being thus disposed, the Fathers entered the Council, and held their Sittings regularly every Day, beginning by the Examen of the most important Affair, which was that of *Arius*.—They began, according to Custom, by reading his Doctrine, which he had delivered in Writing, in the Form of a Profession of Faith; but when the Council heard that the Son of God had not been from all Eternity; that he was a *Creature, form'd of nothing*; the three hundred Bishops could not help shewing by exterior Signs, how much they abhorred and detested such Blasphemies; but however, to observe the Formalities requisite on such Occasions, and act according to the Rules of a just Judgment, they ordered *Arius* should be heard in his Defence, who accordingly was heard often in the Council, and had all the Liberty allowed him, as well to justify himself, as to answer all that was objected against his Doctrine, especially by *Athanasius*, Deacon of *Alexandria*, whom his Patriarch had brought to the Council, on Purpose to oppose him to *Arius*, as the most learned of all those he had himself instructed in the Doctrine of the Church.—*Athanasius* discharged the Trust reposed in him, with so much Judgment, Learning and Eloquence, that he filled the whole Council with Admiration, and the *Arians* with Confusion, for which they could never forgive him afterwards.

We learn from *Rufinus*, *Sozomen*, and *Nicephore*, that when the Controversy among the *Theologians* was over, the Fathers used to examine, by themselves, all that had been produced or advanced on either Side, and make an exact Discussion of all the Passages of the Scripture, which those *Theologians* had offered to support their respective Sentiment.

The *Arians*, who saw, by the unanimous Disposition of the Fathers to oppose their Doctrine, that they ran the Risk of being condemned by the Council, if they could not disguise their Sentiments under some Expressions which they could afterwards interpret in their Favour, and which at the same Time might be agreeable to the Orthodox; offered at last, to confess that the *Word is God, and of God*.—But as the Fathers perceived that, even in that, there was some Artifice, since the same Expressions could be extended even to Men, they desired the *Arians* should add to it, that he was *the Wisdom, and perfect Image of his Father subsisting within him, and always immutable in every Thing*; the *Arians* consented also to this, expecting to find, even in these Expressions, some Eva-

sions, which could favour their Doctrine, for, said they then among themselves, *the same Thing may be said of Man, who is also called in the Scripture the Image of the Glory of God*.—Therefore, the Fathers, seeing that there was no trussing to the Sincerity of the *Arians*, nor no depending on their Promises, consulted among themselves how to find some Expressions, which could express clearly the Sense of the Council, without being subject to Equivocation: The Letters of *Eusebius* of *Nicomedia*, furnished them with what they wanted, for remembering then they had read in those Letters these Words; *if we say that the Son of God is uncreated, by that we confess he is CONSUBSTANTIAL to his Father*; they understood, thereby, that those Hereticks hated nothing more than that Word *consustantion*, *Consubstantial*, which in Fact destroyed entirely all their Errors, in exposing clearly this Truth contained in the Scripture, that the Son is not only a Likeness of his Father, but is of the same Substance with him, and consequently eternal, uncreated, not made, but begotten; as wise, as good, and as potent as his Father; therefore to bring the *Arians* to the Orthodox Belief, and to cut off at one Blow the Heads of that *Hydra*, *ARIANISM*, it was proposed to them to sign the *Consubstantiality* of the Word. But when they saw themselves so closely pursued, as to admit of no Evasion or Equivocation, they threw off the Mask, and protested they would not do it; which was enough to convince the *Orthodox*, that the *Arians* never designed to act with Candour and Sincerity; therefore from that Time the Fathers took the Resolution never to abandon that Expression *consustantion*, *Consubstantial*, which henceforward should be a Mark of Distinction between the *Orthodox* and the *Arians*; so that, as there was no Proceeding further in the Council, each Party persisting in his Resolution, the Fathers were obliged to inform *Constantine*, that there was nothing left to do, but to fix a Day for the Decision of that grand Affair by a solemn Judgment, which the Emperor had declared he would honour with his Presence.

The Day being come, says *Eusebius*, l. 3. c. 10. The three hundred and eighteen Bishops came soon in the Morning to take their Places in the Hall; and waiting in Silence the Arrival of the Emperor, for whom a Chair of State had been prepared at the upper End of the Hall, in the Middle, between the two Ranks of Bishops; so that those who were on the left Side of the Hall, says *Sozomen*, c. 18. had the Right of the Emperor, and those on the Right, his Left.—At the Sound of the Trumpets, which announced his Arrival, all the Fathers rose from their Seats to receive him, with all the Respect due to the Master of the World, which they shewed by a Sort of religious Veneration, when they saw him in the Pomp of a Majesty, which represented more perfectly than ever that of God himself.

That Prince was the finest Man in the whole World, his Height above the common, and extraordinarily well-shaped; he had a very agreeable Face, and though then above 50, he was of a very good Constitution, had a very fine Complexion, says *Nicephore*, l. 8. c. 16. and 55. a very great Sweetness in his Features, fine Eyes, full of Vivacity, and a certain Air of a virile Beauty, which joined to that of a Hero, claimed the Admiration, and almost the Adoration of the whole World.—He was dressed that Day in Purple, like a *Roman* Emperor, his Head, instead of Laurels, which he had quitted ever since he became a Christian, to have nothing which could smell of Paganism, was adorned with a Sort of Diadem, enriched with Jewels.

In that State he crossed all the Chambers and Halls of his Apartments, and when he came near that of the Council, he ordered his Guards to retire, and entered the Place, with only the Officers of his Household, who accompanied him, and who were all Christians.—’Twas then he appeared to the whole Council as an Angel sent from Heaven; for in Fact, there had not been seen yet the human Greatness,

Greatness, and the Christian Humility so judiciously allied on so great a Prince, as on that Occasion; passing through the Middle of the Hall between the Bishops, who all saluted him with a great Deal of Respect; he went to place himself on his Seat, from whence he saluted all the Fathers with an Air of Goodness which ravished the whole Assembly.—He had ordered his Seat should be lower than theirs, to shew the Honour he did to the Church represented by so holy an Assembly; but he would also have it of Gold, and placed at the upper End, to render to its Dignity what was due to it.—He would not seat himself before the Bishops had obliged him to it, which shewed the Deference he had for the spiritual Powers; but to act at the same Time, as a Master, he seated himself first, all the Bishops standing, 'till he had ordered them to sit likewise.

As soon as the whole Assembly was sat, the Patriarch of *Antioch*, *Eusebius*, began the Ceremony, says *Theodoret*, l. 1. c. 7. by a short and strong Harangue on the Subject of so august an Assembly.—‘He returned Thanks to God for having given them a Prince, to whom he had also given the Empire of the World, to establish therein the true Religion, which he maintained with his Arms, his Laws, and his Examples; that in exterminating the Tyrants, he had also destroyed a Tyranny much more cruel than theirs, that is to say, that of the Devil; that his Temples were ruined, his Altars thrown down, and his Sacrifices abolished.—That Light had succeeded to Darkness, Truth to Falshood, and the Worship of the true God to Impiety, which had triumphed during so many Centuries; that, at last, instead of Creatures and Devils, who had so long usurped the Divine Honours, *the Father, the Son, and the Holy Ghost*, THREE PERSONS IN ONE GOD, was then adored throughout the whole World.—That such Thing was in Fact the Master-piece of his Power and Piety, which God would have perfected by his Hand; but that the same great Architect, expected also, from him, he should not suffer *Herefy* to destroy so precious a Work.—That to attack the great Mystery of the Trinity, and divest *Christ* of his Divinity, was endeavouring to ruin the Foundations of the Christian Religion.—That the Devil, who is the Author of Idolatry, seeing it ruined by the Arms and Piety of *Constantine*, was attempting to re establish it in another Manner among the Christians, by the Malice and the Errors of *Arius*. For if he had persuaded the Idolaters to adore a Creature, like God, he would make Use of that Heretick, to oblige the Christians to place among the Creatures the God whom they adored.—Therefore it was of *Constantine*’s Glory and Piety to destroy the Work of the Devil, in preserving that of God, and to deliver the Church from an Enemy, who made a more dangerous War against it, by his Impiety, than all the Tyrants by the Fury of their Persecutions had ever done.’

The Patriarch having ended his Discourse; the Emperor, keeping his Seat, and with a becoming Majesty, which commanded the Attention of the whole Assembly, spoke in the following Terms, transmitted to us by *Eusebius*, *Sozomen*, *Theodoret*, l. 1. c. 7. and *Nicephore*, l. 8. c. 16.

‘If I am the most obliged of all Mankind to return Thanks to the great God of Heaven and Earth for so many Favours and Benefits I have received from his munificent Hand, I must confess that it is on this Occasion, I am more particularly obliged to acquit myself of that Duty; since in seeing you all assembled in this sacred Council, I receive the greatest Good I have ever desired, to deliver us from the greatest Evil. We have vanquished the Tyrants who had declared War against the true Religion, which we have made so gloriously triumph over all those merciless Enemies, by so many Victories which we are indebted for to the omnipotent Saviour of the World, who has made us conquer,

while fighting under his Standards.—I thought nothing remained to do after that Triumph, but to reap, in a perfect Tranquillity, the Fruits of those happy Successes, by making flourish throughout this Empire the Worship of the true God, who is the Author of all these Benefits.—This was what I was preparing myself for, when I heard, with Sorrow, that we had yet to fight a still greater Enemy than all the Tyrants, I mean that unhappy Division, which the Devil, to be revenged of the Loss of his Altars, and of his Sacrifices, has spread amongst you on the most essential Points of Religion.—This is, (and you know it by a fatal Experience) the most terrible of all the Persecutions the Church could suffer. Since the Rage of those we have vanquished, could attack but the Body, which they rendered still more glorious, by the Marks of the Constancy of the Soul, which we have the Satisfaction to admire yet in those illustrious Confessors of *Christ* we see in this Assembly.—But the Rage of Division spreading itself in the Minds, and penetrating the Hearts, spirits up the one against the other, troubles the Peace, and destroys the Faith, by rendering it uncertain, fills all with Trouble and Confusion, and exposes our Religion to the Blasphemies of our Adversaries, who make Use of our Divisions to turn us into Ridicule.—I thought nothing could cure those Evils but the whole Church, acting under Authority, in this holy Assembly. I have contributed all in my Power towards its Convocation; and now that I see it so numerous, and so full of so many great Men, I feel within my Soul a Joy which is inexpressible; for I do not at all question, but as you are here all re-united in one and the same Body, you are also to re-unite in one and the same Spirit, to restore to the Church its former Peace and Tranquillity.—Act then, Ministers of the Living God; act together, and in Concert, to appease the Disorder, in deciding by the Oracles of the sacred Books, what must be our Belief on the Points in Dispute. You have yet the Liberty to declare freely your Sentiments on that Subject; but they must be all re-united at last, in one and the same Sentiment, which will end the Controversy.—I command you to do it, as your Emperor and Master, and desire it, as one, who has the Honour, like you, to be the Servant of the same Lord, and of the same Master, we all serve, and we all worship.—If you do it you’ll render to God a very agreeable Service; and I must say it, you will oblige your Emperor, who expects that from you as a Favour which I’ll never forget.’

Eusebius, and his Partisans, seeing very well that there was no Resource left for them, if in *Constantine*’s Presence, they could not gain something by the Dispute, made their last Efforts, to defend their Doctrine, or to elude a definitive Judgment by the Difficulties they would start up. The Orthodox, on the contrary, stood firm in the Defence of the Truth, and, strengthened by the Presence of a Prince, who had so much Zeal and Piety, opposed with a still greater Zeal, than they had done yet, the great Truths of the Scripture, and the ancient Belief of the Church, from the Time of the Apostles ’till then, to the vile Subtilties of the Hereticks; so that their Minds being over-heated on each Side, the Contellation was carried further than it had ever been on the like Occasion.

Constantine, who was willing to re-unite their Spirits by fair and easy Means, heard them on both Sides with an admirable Patience, praising these, moderating the Heat and Passion of those, speaking familiarly to all in *Greek*, and forgetting nothing of what an excellent Moderator could do, to end the Dispute as happily as this was ended in the Council.

In Effect, as soon as by the Emperor’s Order the Suffrages were asked for, more than three hundred Bishops having with an unanimous Consent declared for the Truth, which they had always defended with so much Constancy in the Dispute; the *Son of God* (so *Constantine*’s

Constantine's great Satisfaction,) was declared CONSUBSTANTIAL to his Father, and perfectly equal to him in all his divine Perfections, according to the Formule of Faith made by *Osus*, one of the *Presidents* of the Council, with the Condemnation of *Arius's* Doctrine, reduced to some Propositions which were anathematized, together with those, who should have the Temerity to maintain them.

Eusebius of *Nicomedia*, and sixteen Bishops of his Partisans, willing to make a last Effort, opposed the Decree, and rejected with Scorn the Word *Consubstantial*; but *Constantine*, says *Sozomen*, c. 20. declared immediately, that he would have what had been decreed, inviolably observed, and those who should refuse to submit to it, sent into Exile, as impious Men, who had the sacrilegious Temerity to oppose the Decrees of God himself. This was the Cause that some of those who were not willing to incur the Emperor's Indignation, or to lose their Bishopricks, chose rather to yield to the Torrent, and to sign what was desired of them. But among the rest *Eusebius* of *Cæsarea*, who having hesitated at first what he should do, and had even protested he would not do it, finding, after a serious Reflection, that it was better to keep his Metropolitan Church, and the Favour of the Emperor, than that of *Eusebius* of *Nicomedia*, whose Party he had espoused for no other Reason, than to be capable, through his Means to advance himself at Court.—Therefore the Day following he came to the Council, and signed publickly, and without Restriction, the CONSUBSTANTIALITY of the Word, and the Condemnation of *Arius*; though in his Letter to his Church, he wrote a few Days after, says *Athanasius*, *De. Decr. contr. Ar.* he used so much Disguise and Artifice, in explaining the Term *Consubstantial*, that it plainly appears, that to save his Honour, he would have it understood, that he had not changed, but always understood it in the Sense he gave it then.

Moreover the Bishop of *Nicomedia* surprised to see himself deserted by the greatest Part of his Creatures, began to consult with the few left near him, how to find some Means to divert the Tempest, without being obliged to subscribe to the Formule, which was offered to them; and they judged that there was but one Expedient left, which was to present another Formule, conceived in Terms less odious, which the Council could receive for the Sake of Peace, and which themselves could interpret afterwards in their Manner, and in the hidden Sense they kept within themselves.—Having then composed that Formule, they presented it to the Council, as if it had contained the same Doctrine, which had been just established, and differed only in some certain Expressions, which were not capable to hinder the Union among them. But after it had been read, without having found in it the Term *Consubstantial*, nor the Condemnation of *Arius*, who had been anathematized, because he persisted in his Heresy, then the whole Assembly, says *Theodoret*, l. i. c. 7. cried with one Voice, that the Formule was nothing else but a pure Illusion, which under ambiguous Terms disguised the Error to hinder its just Condemnation; and which provoked so much the Indignation of the Council, that the Formule was tore in Presence of the Bishops, who had presented it, who were called then publickly Rebels to God, and Traitors to Religion. That Action surprised so much *Eusebius's* few Partisans, that *Menophantes* of *Ephesus*, *Patrophilus* of *Scythopolis*, *Narcissus* of *Neronias*, and *Maris* of *Calcedonia*, who were the most considerable among his Friends, forsook him, and went to sign the Formule of the Council; so that none remained with *Eusebius* but *Theognis* of *Nicea*, *Theonas* of *Marmarick*, and *Secundus* of *Ptolemaides*.

Notwithstanding all this, *Eusebius* could not be persuaded yet to submit, so unwilling is the Chief of a Party, especially in Matters of Religion, to lose the Credit and Authority he has acquired over his Partisans.—For that End he found out a Subtlety, which he judged very proper to protect him

against the Thunder, which he feared from the Council, by his Deposition, and from *Constantine*, by being sent into Exile.—There were two Parts in the Formule drawn by *Osus*; one was the Profession of Faith we make every Day in the Symbole of *Nice*, wherein the Term *Consubstantial* is implied; the other was the Condemnation of certain Propositions, extracted from the Discourses and the Books of *Arius*. The first contained only the Right, in the simple Exposition of the Catholick Truth; and the second contained the Right and the Fact joined together, in the Condemnation of *Arius's* Doctrine.—*Eusebius*, after having carefully examined that Formule, concluded that, to puzzle the Fathers, he had nothing else to do, than to make a Distinction between the Right and the Fact, and thereby save *Arius's* Doctrine.—He represented then, to the Council, in the most respective Terms, says *Sozom.* l. i. c. 20. 'That he submitted to all its Decisions which related to the Faith, and consented to subscribe to it, even admitting the Term *Consubstantial*, in its true Signification, and consequently maintained no Error; but as for the Condemnation of *Arius*, he could not subscribe to it; not that he would reject all the Points of Faith which had been decided, but because he did not believe the Person accused guilty of the Errors attributed to him; on the contrary, he was entirely persuaded, as well by his Letters, and by the several Conferences he had had with him, that he had quite other Sentiments than those for which he was condemned.'—It is difficult to imagine a greater Boldness, and less supported with Sense and Judgment, than was that of this Bishop on this Occasion, since the Fathers had the Writings of *Arius*, which had been read and examined in the Council; himself had often been heard in the Dispute, and permitted to explain his Sentiments; and his Protector had nevertheless the Impudence to maintain, that the Sense of that Heresiarch had not been very well understood, which was a Fact he could by no means call in Question.—Therefore the Council, justly provoked at his unjust Proceeding, and seeing him remain inflexible, and to refuse obstinately to subscribe to the Condemnation of *Arius*, the four Bishops were at last condemned as Hereticks, and deposed, the Council being persuaded that *Constantine* would confirm their Judgment.

They were not frustrated in their Expectation, for the Emperor condemned *Arius*, and the four Bishops, who had refused to subscribe to his Condemnation, to Exile.—That just Severity of *Constantine*, even against the Person who was supposed to have so much Credit at Court, by the Favour of the Empress *Constantia*, struck the Rebels with Fear, conquered their Pride, and obliged them to do, at least outwardly, all that was desired of them.—For *Arius* first, and his two principal Disciples, *Euzoius* and *Aebillas*, affecting to be entirely undeceived, desired the Fathers with all the Submission imaginable, that they would admit them into their Presence, since they were ready to submit to every Thing without Exception. Accordingly the Council, imitating the Goodness of him they represented, received their Request, and they were admitted into the Assembly, where having given satisfactory Answers to every Thing that was asked of them, and abjured their Heresy, they were re-established in the Exercise of their Ministry, but on Condition they should not re-enter *Alexandria*, where they had caused so much Disorder.—The two *African* Bishops, *Theonas* of *Marmarick*, and *Secundus* of *Ptolemaides*, the two first, who had been seduced by *Arius*, whom they had followed blindly since, followed also his Example on this Occasion, and were likewise received into Favour.

Eusebius of *Nicomedia*, seeing himself thus deserted by every Body, even by the very Person who had been the Cause of all the Disorder, began to think that if he persisted in his Sentiments, he should certainly lose his fine Bishoprick, and have the Decree of the Emperor executed against him; with his faithful Companion *Theognis* of *Nicea*, the only one of his

his Partisans determined to follow his Fortune, presented a Request to the Council, desiring the same Favour which had been granted to *Arius*, since they were determined to submit their Judgment to that of the holy Council, and to do whatever should be asked them.—The Fathers, who wished for nothing more than to see the Re-union of all the Members of the Council, received those two Bishops with open Arms, who by a sincere Repentance seemed to return to their Duty. This Step taken by *Eusebius*, and the pressing Sollicitations of the few Friends he had at Court, engaged the Emperor to forgive him, therefore he was once more re-established by the Council, and retaken into the Favour of his Prince; so that the Heresy of *Arius* was at last condemned by an unanimous Consent of 318 Bishops, who all subscribed to that Condemnation, and to the Formule of Faith, which established the *Consubstantiality* of the Word: Though *Socrates* assures us, that *Arius*, *Eusebius*, and *Theognis* persisting in their Obstinacy, were sent into Exile by the Emperor; and that it was after they were arrived at the Place of their Banishment, that they presented their Retracting.—The same Historian speaks in very advantageous Terms, of the Reconciliation to the Council of *Eusebius*, Bishop of *Cæsarea*, who as we have observed already, having made Difficulty at first, to receive the Formule of Faith, consented at last to sign it with the rest of the Fathers; and sent it thus signed, says *Socrates*, to his Diocesans, with an Explanation of the Term *Consubstantial*, for Fear the Difficulty he had made to sign it at first, should make them question the purity of his Faith. This is the Manner he wrote to them on that Subject; as related by the same *Socrates*, l. i. c. 8.

‘ You must have learned already, dearly beloved, what has been decreed in the sacred Council of *Nice*, concerning the Faith; since Fame anticipates always the most exact and most particular Relations. But for fear it should have related Things otherwise than they have happened, I have judged it proper to send you the Formule of Faith, such as I have proposed it, and with it the Additions made to it by the Fathers, before it was published. — This is ours, such as it has been read in Presence of the Emperor, and approved by the Council; such as we have received it from the Bishops our Predecessors; such as we have learned it from our Infancy, when we received the Baptism; such as it is contained in the holy Scripture; such at last, as we have taught it, as well in the Order of Priesthood, as in the episcopal Dignity, and such as we all profess, at present.

‘ We believe in one God, Father Almighty, who has created all Things visible and invisible, and in one only Lord Jesus Christ, *Word of God*, God of God, Light of Light, Life of Life, only Son, first formed of all the Creatures, begotten by God the Father, before the Times, by whom all Things have been made, who has took Flesh for our Salvation, and has conversed among Men, who has suffered and risen the third Day; who ascended to his Father, and who is to come again full of Glory to judge the Living and the Dead. We believe also in the Holy Ghost. We believe the Existence and Subsistence of each of them, that the Father is truly Father, the Son truly Son, and the Holy Ghost truly Holy Ghost, as our Lord declared it, when he sent his Apostles to preach the Gospel, saying, *Matth. c. 28. Go and teach all People, baptizing them in the Name of the Father, and of the Son, and of the Holy Ghost.* We protest that we believe that Faith, that we have always believed it, and that we’ll believe it to the latter End of our Days; condemning the Impiety of all Heresies. We also protest in the Presence of the omnipotent God, and of our Lord Jesus Christ, that we have retained sincerely all these Things ever since we have been capable to know ourselves, and are ready to shew by uncontrollable Proof, and

‘ to convince you that we have always been of that Belief, and always preached it. When we proposed this Formule of our Faith, no Body found Fault with it. Our Emperor, God’s beloved, approved it first, and exhorted the others to sign it, in adding only to it the Term *CONSUBSTANTIAL*, himself explained that Term, saying that he did not understand it of the Proprieties of the Body, and that he did not believe he subsisted of the Father by Division or by Section; because an incorporeal and intellectual Nature cannot have a corporeal Property, and that must be understood in a spiritual and divine Manner. Thus it was explained by that wise and religious Prince. The Bishops taking Occasion of that Term of *CONSUBSTANTIAL*, drew up the following Formule.’

S Y M B O L E.

‘ We believe in one God, Father Almighty, who has created all Things visible and invisible; and in one only Lord Jesus Christ, God, only Son, begotten by the Father, that is to say, of the Substance of the Father, God of God, Light of Light, true God of true God, who has not been made, but begotten; who has but one same Substance with the Father, *CONSUBSTANTIAL* to the Father, and by whom all Things which are in Heaven and on Earth have been made; who is descended from Heaven for us miserable Men, and for our Salvation, who was incarnated, became a Man and has suffered, who rose the third Day, has ascended into Heaven; from whence he is to come to judge the Living and the Dead. We believe also in the Holy Ghost. As to those who say that there has been a Time when he was not, and that he was not before he was begotten, that he has been made of what was not before; that he is of another Nature and of another Substance than the Father, that he is created and subject to Change; the holy Catholick and apostolick Church pronounce *Anathema* against them.

‘ When they had dictated this Formule of Faith, we thought it our Duty to examine what they had said, that the Son was of the Substance of the Father, and *CONSUBSTANTIAL* to the Father. Several Questions and Answers were made to discover the true Sense of those Terms. They confessed that the Sense was, that the Son is of the Father, but not as one of his Parts. We believe it just to receive that Sense, because it is a wholesome Doctrine to say that the Son is of the Father, but not as a Part of his Substance. We receive that Idea, and we do not so much as reject the Term *CONSUBSTANTIAL*, for the Good of the Peace, and for fear, in doing it, we should deviate from the Truth. We have approved for the same Reason, *begotten*, and not *made*; because they say that the Term *made*, is a Term common to all the Creatures made by the Son, to whom he is not *semblable*, being of a superior Nature; that he has his Substance from the Father, according to the Scripture, by a secret Generation which no Spirit can comprehend, nor no Discourse express. That Manner thereof the Son is *CONSUBSTANTIAL* to the Father, having been examined, it was agreed that it was different from that of Bodies; because it is not by Division of Substance, nor by a Change of the Nature and the Virtue of the Father. That when it is said that the Son is *Consubstantial* to the Father, nothing is thereby understood, but that the Son of God has no Likeness with the Creatures who have been made by him; but that he has a perfect Likeness with his Father, by whom he was begotten; that he is of the Father, not of another Hypostasis, nor of another Substance. That Doctrine having been explained thus, we believe we ought to approve it, because we have found that ancient Bishops and learned Writers have made Use of the Term *CONSUBSTANTIAL*, to explain the

Divinity of the Father, and of the Son. This is what I had to say to you, relating to the Faith which has been proposed in the Council of *Nice*, and to which we have all consented, not without Consideration and Deliberation; but after we have examined in the Presence of the most religious Emperor, the Sense that I have inserted here, and approved it for the Reasons above-mentioned. We have also consented, without Difficulty, to the *Anathema* which has been pronounced after the Formula of Faith, because it forbids to make Use of foreign Terms, and different from those expressed in the Scripture, it being certain that from those foreign Terms proceed all the Differences and Troubles in the Church. The Scripture dictated by the Holy Ghost, having then never made Use of these Terms of *what is not*, it has been a Time when *he was not*, and the like quoted in the same Place; we have not thought it reasonable to use them or to teach them. We have the more willingly submitted to the Decrees of the Council in this Particular, in that we never used to employ those Terms. We believe it our Duty, dearly beloved Brothers, to inform you of all these Things, that you may judge with how much Prudence and Deliberation we have suspended or given our Consent, and to let you know how much we have had Reason to resist, almost to the End, while we were shocked at certain Terms which had been reduced into Writing; but at last, we have received without Contestation, what, after a mature Examination, we have found agreeable to the Faith we have always professed.—This Letter, says *Socrates*, was sent by *Eusebius* to *Cæsarea* of *Palestine*.

The same Historian gives us also an Extract of another Letter written by the Emperor *Constantine* himself, to the Church of *Alexandria*, on the same Subject, which, to confound the *Arians* of these present Times, I'll insert here as I have translated it, as well as that of *Eusebius* of *Cæsarea*, Word for Word, from an Original in *Socrates's* History.

Constantine August, to the Catholick Church of Alexandria.

Beloved Brothers, Greeting. We are indebted to the Divine Providence, for having delivered us from Error, and re-united us in the same Faith. The Devil will have no longer any Power against us, since all the Machines he had raised for our Destruction are entirely ruined. The Truth has appeased our Differences and Tumults, its Strength has conquered the Malignity of our Inveteracies, Disputes and Jars. We all believe and worship the same God; to obtain this salutary End I have assembled, by his Succours, a great Number of Bishops at *Nice*, with whom I, who make but one amongst you, and consider as an Honour to serve the same God with you, have examined the Truth. We have seriously and impartially examined all that could be the Subject of Disputes and Controversies. I pray God to forgive to some, the Impudence and Enormity of the Blasphemies they have vomited against the Honour of our Saviour, against the Hope of our Salvation, against the Authority of the Holy Scripture, and against the Truth of our Faith, more than 300 Bishops all reputable for the Eminence of their Learning, and for their Moderation, having all agreed to the Truth of our Faith, which according to the holy Scripture, can be but one; none but *Arius*, deceived by the Craft of the Devil, has spread the Error amongst us, and afterwards amongst others. Let us receive the Doctrine we have received from God Almighty. Let us return to our Brothers, from whose Society that wicked Minister of the Devil had separated us. Let us make Haste to be re-united to our Body and to our Members. The Prudence, the Religion, and the

Holiness you profess, oblige you to have Recourse to the Grace of God, after you have discovered the Errors of him who is certainly the Enemy of Truth. The Doctrine the 300 Bishops have agreed upon cannot be but the Doctrine of God; and we are obliged to believe that they have all been inspired by the Holy Ghost, who has discovered to them his Will. Let none of you doubt; let none differ. Re-enter all quickly the Road of Truth, so that when I shall come to you, I may return Thanks to God, that he hath re-united you all in the Truth of Faith, by the sacred Tie of a Christian Charity. God preserve you, dear Brothers.

This is what the Emperor wrote to the People of *Alexandria*, continues *Socrates*, to assure them that the Decisions of the Council had not been made without Reflection, but after a very serious and impartial Examination; that nothing had been dissembled or omitted; and that every Thing had been proposed which could have contributed towards discovering the Truth; so that there remained no Subject of Controversy or Dispute: And to say all in a few Words, he called the Sentiments of the Bishops assembled at *Nice*, the Sentiments and the Will of God, and that he did not question but their Union was procured by the Holy Ghost.

Socrates recites another Letter of the Emperor, against *Arius*, and his Partisans in the following Terms.

Constantine Conqueror, most Great, August, to the Bishops, and to the People.

ARIUS having followed the Example of the Impious and of the Wicked, deserves to be covered in Infamy with them. As *Porphyrius* an Enemy of the true Piety has composed Books against the Christian Religion, which have rendered his Name odious to all honest People, and those Books have been suppressed; we have judged proper that *Arius*, and his Partisans should be called, henceforwards, *Porphyrians*, that they might be stigmatized with the Name of him they have imitated in his Impiety. That if some of *Arius's* Books should be found, we condemn them to the Flames, to hinder their being transmitted to Posterity; and whosoever shall be found to have hidden some of *Arius's* Books, instead of burning them, shall be punished with Death. I pray God preserve you.

Every Thing having been thus happily terminated at *Nice*, the Council which had begun the 19th of *June*, according to *Euseb. l. 3. de vit. Const. c. 14.* was concluded the 25th of *August*, of the same Year 325, and after the Bishops had been splendidly entertained for several Days successively, after the Conclusion of the Council, by *Constantine*, who loaded them with Presents, they all prepared to return to their respective Dioceses; carrying along with them, all over the Earth, the Trophies of *Jesus Christ*, and the Glory of *Constantine*.

The Patriarch *Alexander* was no sooner arrived at *Alexandria*, Conqueror of the *Arians*, but he applied himself wholly to keep them in their Duty, and to make them observe with the greatest Exactness the Decrees of the Council; placing the Schismatick to the lower Rank, as the Council had ordered it; and as *Arianism* had began by a Priest who governed then one of the Churches of *Alexandria*, he would not suffer since that a Priest should preach there; and notwithstanding his great Age, and the vast Number of Inhabitants, he reserved to himself the Power of Preaching, which according to *Sozomen, l. 7. c. 19.* was practised by his Successors for a considerable Time afterwards.

Moreover *Alexander* did not enjoy long the Fruits of his Victories, for he died full of Years, and of good

good and truly christian Deeds, five Months after his Return, and was succeeded in the Patriarchate by one *Theonas*, elected by the schismatick Faction. But he lived but three Months after his Election, which had always been considered as void, by the People of *Alexandria*; and as soon as *Atbanasius*, whom his Patriarch had sent to Court, about the Affairs of his Church, was returned, the Synod of all the Orthodox Bishops of *Egypt*, *Lybia*, *Thebaides*, and of *Pentapolis*, chose him, to the incredible Joy of all the People, who came from all Parts to ask, as they did, that *Atbanasius* should be placed on the Throne of St. *Mark*.

The Heterodoxes irritated at that Election, and perceiving that *Atbanasius* acted with a still greater Zeal than his Predecessor had done, rebelled openly against him, and caused more Trouble in *Egypt*, than had done the Authors of their Schism. *Eusebius* of *Nicomedia* in particular, who had concerted *Atbanasius*'s Ruin, strengthened by the Party of the *Meletians*, whom he had found the Secret, by his Intrigues, to engage into the common Cause, against the Patriarch of *Alexandria*, began to execute what he had projected against him.——Persuaded that the surest Expedient to succeed in his Enterprise, was to prejudice the Emperor against *Atbanasius*, which could not be done otherwise, than persuading him that *Atbanasius* disturbed, by his Violences and Oppressions, the Peace and Tranquillity *Constantine* had procured to the Church in the Council of *Nice*; made use for that Purpose, of some Schismatick Bishops he had sent for from *Egypt*, who being introduced to *Constantine* by *Eusebius*'s Friends at his Court, threw themselves at his Feet, imploring his Protection, says *Sozomen*, l. 2. c. 21. against a young Man, who was upheld by *Alexander*, his Protector, who had even designed him for his Successor, against the Laws and the Liberties of the Church, had seated himself, by Surprise, and the Faction of some Bishops, who had elected him clandestinely, upon the episcopal Throne of *Alexandria*. That they had suffered his Intrusion rather than disturb the Peace, if the Intruder, abusing of an Authority he had stolen, had not exercised throughout all *Egypt* a Tyranny very little different from the Fury of the Persecutions of *Licinius* and *Maximinus*; that under the specious Pretext of having the Laws of the Council observed, he made the Christians suffer Torments, which the *Pagans* themselves had spared them; that therefore they desired his Majesty, whom they considered as their Master by his Power, and as their Father by his Goodness, to employ the one to deliver them of so much Misery, and to make Use of the other to maintain them in their Right, and in their Order, and to make them enjoy the Peace he had lately given to the Church.

The Emperor answered, says *Eusebius*, l. 5. c. 22. That he wished for nothing more than for the Peace of the Church, as it had been established in the Council of *Nice*; that he was glad to see them ready to submit to it. That he would write into *Egypt*, to be informed of the Truth of those Things alledged by them, and take Care that the Peace should be religiously observed, according to the Decisions of the Council.

Mean while *Eusebius*, who was willing to re-establish *Arius* on *Atbanasius*'s Ruin, dispatched a Man, whom he instructed how to behave, with Letters to the Patriarch, in which he desired him, in a civil Manner, to re-establish *Arius* in *Alexandria*, himself having been Witness of his Submission, and the Obedience he had rendered to the Council; that it was enough to fulfil the Decree, he had been a Year without returning, and that the only Means to make a good Reunion, was to take off that Distinction which henceforward would be too odious and might cause new Troubles.

The Envoy, who found *Atbanasius* not at all disposed to give a favourable Answer to *Eusebius*'s Letter, following the Instructions of his Master, (who all

the while had foreseen the Refusal,) threatened the Patriarch, and told him in private, that he was lost, if he refused to oblige Persons, who, being secretly supported by all who were the most in Favour at Court, had in their Hands an infallible Means to accelerate his Ruin. The Patriarch answered with great Calmness, that he would satisfy his Conscience, and answer the Person who had sent him.

In Effect, we see in *Atbanasius*'s *Apologetick*, that he wrote to *Eusebius*, that as the Hereticks and Penitent Schismaticks ought to be reconciled, the Chief of the Party, and the Authors of Heresy, condemned publicly by the Church, were not to be trusted. That for his Part he was fully determined never to receive them in *Alexandria*.——And as he heard the Calumnies of his Accusers near the Emperor, he wrote to him, that *John* and all the others who went every Day to Court to complain of him, were Schismaticks, who had been sacrilegiously ordained against the Decrees of the sacred Council; that they were joined in Interests with the *Arians*, and had even embraced their Errors; and that the one and the other renewed the ancient Disorders throughout all *Egypt*, committing a thousand Outrages against the Orthodox, whom they endeavoured to ruin at Court by their Calumnies.

The Emperor, whose Intentions were just, hearing Things so contrary on both Sides, did not know what Resolution to take, nor even what to believe of it, when the crafty *Eusebius*, who perceived his Embarrass, told him that the surest Means to compose all those Differences in *Egypt*, without being obliged to examine what had been objected on either Side, was to receive those who desired the Peace of the Church, and to be received into the same Communion, particularly *Arius*, wished for in *Alexandria* by all honest Men, and whom *Atbanasius*, who did not love him, and was glad to find the Occasion of being revenged of a learned Man suspected to him, would always persecute as an Enemy, contrary to the Peace and Tranquillity of the Church, since he could object nothing against *Arius*, who ever since the Conclusion of the Council had shewed all Submission and Obedience to it.

Constantine, who loved passionately the Peace of the Church, which he considered as his Work, and was already irritated to see it disturbed by these new Disorders, to the Prejudice of his Authority, was easily prejudiced against *Atbanasius*, and thought that so unhappy a Change could not have happened in *Alexandria*, without his having occasioned it by his too great Severity. Therefore laying hold of the Expedient offered by *Eusebius*, he sent two Gentlemen of his Household, *Synclitus* and *Gaudentius*, to the Patriarch, to whom they delivered the Emperor's Letters, in which, after having reproached him with his Severity, which was the Cause of so much Trouble, he ordered him to receive into the Church all those who should present themselves, and particularly *Arius*, who had given so many sufficient Proofs of the Purity of his Faith. That if he refused to do it, he would soon send Persons, who would oblige him to quit a Place he seemed to be unworthy of, and transport him to another, where it would not be in his Power to offend any Body.

Atbanasius, who discovered in the Emperor's Letters the Artifices of *Eusebius*, answered *Constantine*, with a Liberty truly sacerdotal, and with an extreme Respect as to his Master; and made him so well understand, that *Arius* was nothing else but a perfidious Man, who made a Jest of the Church by persevering in his Heresy, under the Favour of a false Signature, and that to introduce him into *Alexandria* was introducing *Arianism*, that at last he dissuaded him, or at least hindered him from pursuing an Affair, which would have been attended with fatal Consequences.

Eusebius, disappointed in this, raised several other Batteries against St. *Atbanasius*, even so far as to accuse him of the greatest of all Crimes, which was that of having attempted to suborn with Money one

Philumenes, to undertake something against the Emperor, but *Athanasius*, whom that Prince had sent for, on the first Accusations, being arrived at *Nicomedia*, shewed so plainly the Falshood of so horrible an Accusation, that the Prince, persuaded of his Innocence, by his Answers, and of his Capacity by the Conferences he had with him, sent him back to his Church with Praises, protesting that if he had called him it was only to hear him, not to judge him, since that Judgment belonged to the Church.

This Storm having been thus happily dissipated, and the Calumniators *Eusebius* of *Nicomedia*, *Theognis* of *Nice*, *Arius*, and his Disciple *Euzoius* sent into Exile, *Athanasius* could not have suspected that any Thing else could have raised the Courage of his Enemies, so as to pursue him again near *Constantine*, who himself had so gloriously witnessed his Innocence; but as he had to encounter with Hereticks, who are never disconcerted by the Discovery of their Falshoods, but on the contrary, support them with new ones, which puzzle the Minds, and make one doubt if he has not been himself deceived when he thought to have discovered the first; *Eusebius* made use of the Favour of his Protectress, *Constantia*, to have himself recalled from his Banishment, which was no sooner done, but he renewed his Attacks against *Athanasius*, and as he had accused him already of all the Crimes his Malice, Spite, and Revenge could suggest against him, Murder excepted; thinking that nothing else was capable to ruin him without Resource, he employed, in that Design, one *Arsenius*, Bishop of the *Hypselites*, who had hid himself for some great Crime he had committed, and whom they pretended had been killed by *Athanasius*, his declared Enemy, who had also cut off one of *Arsenius's* Hands, to make use of it in his Malefices.

This Accusation having been brought to *Constantine* by *Eusebius's* Emissaries, that Prince ordered that that Affair, which he thought, was of the greatest Consequence, should be carefully inquired into, and intrusted his Nephew *Dalmatius* with it, who was then at *Antioch*, ordering him to do Justice without Remission, if any Body was found guilty of so great a Crime; but as a Bishop was to be judged, he joined two Bishops in the Commission, viz. *Eusebius* and *Theognis*; who had took Care to affect a great deal of Moderation in that Affair, as if they had not been Parties concerned.

Dalmatius, to execute the Orders of the Emperor, cited *Athanasius* before him to answer for the Crime laid to his Charge. He little minded at first this Accusation, trusting to his Innocence; but when he saw that he was pressed hard, and that *Constantine* had taken that Affair at Heart; he had *Arsenius* so well inquired after, says *Socrates* and *Sozomen*, that he was found hidden in a little Monastery of *Thebaides*, where the Superior, who was of *Eusebius's* Faction, and had already made *Arsenius* escape, was seized together with a Monk, who had conducted *Arsenius* through the *Nile*. These having been examined by the Governor of *Alexandria*, confessed all the Treachery. It even happened that those sent in Pursuit of *Arsenius* were so happy as to meet with him at *Tyre*, where having been convicted, and confessed, at last, before the Bishop *Paul*, that he was the true *Arsenius*, he was secured. After which the Patriarch sent his Deacon *Macarius* to *Constantine*, to inform him of all that had passed, and carry to him those convincing Proofs of the Calumny of his Adversaries. The Emperor was so sensibly affected with it, that having immediately revoked *Dalmatius's* Commission, he wrote to *Athanasius* in the most obliging Terms, ordering him to have his Letters read publicly to the People of *Alexandria*, to undeceive them, protesting that, if even those Calumniators were guilty of the same Malice, he would have them punished with all the Severity of the Law.

But *Constantine*, who was easily surprised by a false Appearance of Piety and Religion, and had not in those Affairs all the Resolution he shewed in others,

having the Complaisance to listen to the false Insinuations of some hypocrite Bishops *Eusebius* had placed near him, he was soon persuaded by them, that there might have been some Artifice in *Athanasius's* Proceedings, and that for the Good of the Church, a Point of that Consequence should be cleared by infallible Means.—That Advice given by Bishops, for whose Character, and seeming Virtue, *Constantine* had a singular Veneration, made a strong Impression on his Mind; therefore he ordered that that Affair should be revived and discussed in an Assembly of Bishops, who should be answerable for it to God; and fixed at that Time *Cesarea* of *Palestine* for the Place of that Assembly; but reflecting afterwards, says *Eusebius*, l. 4. *De Vit. Constant.* that *Cesarea* might be suspect to *Athanasius*, because of *Eusebius*, who was Bishop thereof, he appointed *Tyre* the Metropolis of *Phœnicia*.

The Intentions of the Emperor on that Occasion were just, though they had very fatal Consequences; through the Perfidy of those Hypocrites, who deceived him, and who instead of a Synod, made of it a *Conciliabule*, against all the Formalities of the Church. For, first, none were called to that Assembly but those whom *Eusebius* had named to *Constantine*, and who were all *Arians*, or *Meletians*, and all in *Eusebius's* Interest.—These were the two *Eusebius's*, *Theognis* of *Nice*, *Maris* of *Calcedonia*, *Theodorus* of *Laodicea*, *Patrophylus* of *Scythopolis*, *Ursasius* and *Valens*, Bishops, one of *Singidonum*, and the other of *Mursia* in *Pannonia*, and others, to the Number of Sixty.—They had also obtained of *Constantine*, the Count *Denis*, to keep Order, as it were, and to prevent the Trouble and Confusion those Sorts of Assemblies used to be accompanied with; but in Fact to render himself Master of every Thing, and to make Use of his Authority, or rather of his Violence, to do whatever he pleased.—In Fact the Count entered the Council, as he would have done a Field of Battle, accompanied with Officers and Soldiers, who rendered themselves Masters of all the Doors, and ranged themselves round the Seats, as ready to execute at the first Notice, the Orders which should be given them. *Denis* commanded, imposed Silence, threatened, disposed of every Thing, and was in Fact the President of the Assembly, according to *Eusebius's* Desire; so that there was never an Assembly more contrary and more opposite to the sacred Council of *Nice*, where the Emperor himself would enter without being followed by his Guards, and where, far from presiding, he chose a Seat lower than those of the Bishops.

Athanasius, who had been cited to appear at that Council, refused at first to do it, and to acknowledge as lawful an Assembly, composed of his most inveterate Enemies, who had plotted his Ruin; but the Emperor already irritated against him, for his having refused also to go to *Cesarea*, and was pre-occupied of that false Opinion, that it was impossible to procure the Peace of the Church, but through those Means; had him told, that if he would not obey willingly, he would force him to it; so that not to irritate more that great Prince, who perhaps would have thought him guilty, if he had persisted longer in his Refusal, and to hinder his Enemies from accusing him of Rebellion and Contumacy, as they had done, when he refused to go to *Cesarea*, he came to *Tyre*, accompanied with forty-seven of the most celebrated and most holy Bishops of all *Egypt*, who came to defend their Patriarch. Among them were those two glorious Confessors of *Jesus Christ*, *Paphnutius* and *Potamon*, whose glorious Wounds they had received in the Defence of the Faith of *Jesus Christ*, reproached the *Eusebians* with their Cowardice, and their Apostacy in sacrificing to Idols to avoid the Torments of the Persecution.

When the Patriarch entered the Council, no Body took Notice of him, and instead of the first Place, he was to take as Bishop of the first See of the oriental Church, he was not so much as suffered to set down, but was commanded to stand up in the Presence of his Accusers,

Accusers, to hear and answer to the Crimes exhibited against him.—*Epiphanius Heres.* 68, says, that the holy Bishop of *Heraclea, Potamon*, could not bear so great an Indignity, nor refrain his Tears no more than his Zeal, which made him come forth, (and with that generous Liberty, which his Age, his Virtue, and the Advantage he had to carry the Marks of his Confession, gave him,) said to *Eusebius of Cesarea*, whom he perceived among the Judges, ‘ What then, *Eusebius*, I see thee sitting to judge *Athanasius*, and that great Man, who is Innocency itself is here standing before thee, expecting thy Judgment? Couldst thou persuade thyself there could be in the whole World a Soul so base, to suffer such Indignity, without resenting it? Tell me, I desire thee, if thou hast Presumption enough to answer, tell me, if thou wast not in the same Prison with me under the Persecution of *Maximinus*, when, through the Grace of *Jesus Christ*, having always refused to sacrifice to the Idols, I had my Right Eye pulled out, and my left Leg cut off? I cannot walk one Step without remembering it, and though I have but one Eye, I see nevertheless well enough to observe that thou hast two, and that thou art not disfigured by any Wounds; is it for having confessed *Jesus Christ* that the Tyrant has treated us with so much Barbarity, and spared thee? Tell us by what Artifice thou was set at Liberty, while we, loaded with Chains, were conducted to the Supplice, and afterwards condemned to the Mines? is it because being more complaisant than we, thou knewest better how to please *Maximinus*, by burning Incense before him, as well as before his Idols?’—*Eusebius* was so irritated at those Reproaches, that, rising all on a sudden from his Seat, he quitted the Assembly, followed by all his Partisans.

The next Day those unjust Judges having re-entered the Council, *Athanasius* protested he could not acknowledge his Enemies for his Judges; that he was accused by the *Eusebians*, who had long since declared against him for no other Reason, but because he had always opposed the Doctrine of *Arius*, condemned as a Heresy by the Council of *Nice*.—That Protestation caused a great Confusion in the pretended Council, and was look’d upon by *Athanasius*’s Enemies, as a manifest Rebellion against the Emperor, who himself had chose his Judges as Persons of a known Integrity, and altogether irreproachable; and the *Meletians* adding that Crime to so many others they had forged, would have had him condemned by the Judges, who wanted nothing but a Pretext as specious, and as plausible as this to pronounce Sentence against him with some Appearance of Justice; therefore to take off that Advantage, he followed the Advice of the Bishops who accompanied him, and resolved himself to answer, even before that pretended Council, believing as they did, that the Proofs of his Innocency, and the Calumnies of his Adversaries were so manifest, that a Judge, let him be ever so unjust, who could be plainly convinced of it, as they were to be, would not condemn him.

The first Crime he was accused of was also the first Thing which declared him innocent, and convinced his Adversaries of the most horrible Malice.—They had introduced into the Council, says *Theodoret*, *l. i. c. 30.* a common Strumpet, who complained in a lamentable Manner, she had received *Athanasius* in her House on his Passage, with all the Respect due to his Dignity, who had violated all the Laws divine and human, by debauching her in her own House. That when he saw he could not conquer her Constancy by his infamous Sollicitations, he had used Violence, had entered her Chamber in the Night Time, and ravished, by main Force, her Virginity, which she had consecrated to God; to which Accusation the Patriarch was ordered to answer; but as he had received Information under-hand, that such an infamous Woman was to be produced against him, and knew besides, that that Woman had never seen him, he left one of his Deacons to answer, whom the Prosti-

tute took for him, protesting that he was the Person who had ravished her, and demanded Justice for so enormous a Crime. Then *Athanasius* asked the Judges, that since the Imposture had been discovered, the Woman should be seized, to know of her who were the Authors of the Calamny; but these crying in Confusion, that there were a great many more Charges against him, favoured her Escape; and mean while ordered *Athanasius* to answer on the Homicide he was accused to have committed on the Person of the Bishop *Arsenius*, presenting him at the same Time with the Hand of a dead Man.—*Athanasius* asked his Accusers, says *Socrates*, *l. i. c. 29.* if they knew *Arsenius*, and several answering that they knew him perfectly well, he had him produced in the Assembly with both his Hands hidden under his Cloak. As soon as he appeared, the Patriarch asked them once again, if that Man was that *Arsenius* whose Hand was cut off, for methinks, says he, that Man has two Hands. All, except those whose knew from whence the Hand came, were very much surprised, for the others thought *Athanasius* would make his Defence in another Manner. The Conviction of this second Imposture, so shameful and so criminal, proved a Subject of Despair for those who had invented it. *Acab*, or *John*, one of the Accusers, escaped in the Crowd.

The *Eusebians*, thus disappointed in their Accusations against *Athanasius*, began to examine that formed against *Macarius* his Deacon, who by his Orders had insulted, as was pretended, a Priest, whom he had falsely accused of not being such. The poor Deacon was produced in the Council loaded with Chains.—*Athanasius*, who had *Macarius*’s Innocence more at Heart than his own, undertook also his Defence with greater Zeal. He accused first *Eusebius* and his Partisans, alledging that none was to be judged by his Enemies; he pretended afterwards, that it was to be proved that *Ischirus*, who was the supposed Person oppressed and maltreated by *Macarius*, had been honoured with the sacerdotal Dignity. Moreover the Judges went through the Examen of that Affair, without the least Regard to *Athanasius*’s Exceptions; but because the Accusers wanted Proofs, the Decision of that Affair was postponed till a farther Information of the Truth, which was to be made in the *Mareotis*, the Place where the Crime was pretended to have been perpetrated.—Seeing that *Theognis*, *Maris*, *Theodorus*, *Macedonius*, *Valens*, and *Ursacius*, the same he had accused, were those appointed to take the Informations, he complained loudly that it was a Deceit and an Illusion, and that it was not just that while *Macarius* was in Chains, the Accuser should go to inform with the Judges; but now having in vain protested against such Injustice in the Presence of the Bishops, and of *Denis*, Governor of the Province, without any Body minding his Protestation, he withdrew secretly.—Those who had been sent into the *Mareotis*, made the Informations conform to the Intentions of the Accusers, and brought them to *Tyre*.

Mean while *Athanasius* went to the Emperor for Refuge, and was condemned by the Council for having withdrawn. The Deposition having been brought from the *Mareotis*, they deposed him, as convicted of the Crimes of Rebellion, Sedition, Violence against the Bishops, Homicide, Sacrilege and Witchcraft.—They afterwards received *Arsenius* into their Communion, whom they had pretended to have been killed.

The Bishops assembled at *Tyre* went to *Jerusalem*, where they were called by the Emperor, for the Celebration of the Dedication of the new Church he had built there, upon the Sepulchre of our Blessed Saviour, and after the Feast, received *Arius* into their Communion, according say they, to the Emperor’s Intentions, who had informed them that he was very well convinced of the Sincerity of his Faith, and of that of *Euzoius* his Companion.—They wrote to the Christians of *Alexandria*, that *Envy* having been banished (meaning *Athanasius*) the Church enjoyed then a profound Tranquillity, and that *Arius*, having

acknow-

acknowledged the Truth, they had received him into their Communion; they also took Care to inform the Emperor of the same Facts.—While they were writing this Letter, they received one from *Constantine*, by which he called them all to *Constantinople*, in order to examine a-new, the Affair of *Athanasius*, who had implored his Protection.—This is *Constantine's* Letter, as extracted from *Socrates*, l. 1. c. 34.

Constantine the Conqueror, most Great, August, to the Bishops assembled at Tyre.

I Do not know what you have judged in your Council, in a turbulent and disorderly Manner; but those Troubles and those Tempests you have excited through the Desire of Dispute and Controversy, without any Regard to the Will of God, is very prejudicial to the Truth. But the divine Providence will appease one Day those Disputes, and shew with what Sincerity we thirsted after the Truth, and with how much Care we have always avoided being partial in our Judgments. Come to me, to give me an Account of what has been transacted amongst you; you'll learn by what follow the Motives of this Order.—As I was entering this City on Horse-back, the Bishop *Athanasius* with some Ecclesiasticks appeared among the People; I had not known him, if some of my Retinue had not told me who he was, and represented to me the Injustice he had suffered. I could not then speak to him, and he asking for an Audience, I refused it, and was very near ordering him to withdraw. He still insisted upon it, and declared he asked for nothing more than that you should be ordered to come to *Constantinople*, that he might convince me of the Violences he has suffered. His Request appearing to me reasonable, and conformable to my Mansuetude, I am resolved you all, who have assisted at the Council of *Tyre*, shall come here to shew in my Presence the Equity of the Judgment you have pronounced.—Come then with all Speed, and be persuaded that I'll use all my Endeavours to preserve the Laws of God, and to hinder them from being violated, and will punish its Enemies, who under Pretext of Piety, pronounce Blasphemies.

This Letter threw the Bishops of the Council into some Confusion, so that several of them instead of obeying the Emperor's Orders, return'd to their respective Churches: But *Eusebius*, *Theognis*, *Maris*, *Patrophilus*, *Ursacius*, and *Valens*, came to *Constantinople*, where without mentioning the Crimes laid to *Macarius's* Charge, they forged another Calumny against *Athanasius*, and made the Emperor believe, that he had threaten'd to stop the Corn exported every Year from *Alexandria* to *Constantinople*. The Accusation was supported with the Evidence of four Bishops of those who had accompanied *Athanasius* to the Council of *Tyre*, but whom the *Eusebians* had found the Secret to debauch from him; the Emperor deceived by the false Appearance of the Virtue and Impartiality of those perfidious Friends, sent *Athanasius* into Exile at *Treves*, a City of the *Gauls*.—Some Authors are of Opinion, that he banish'd him for no other Reason, than to procure the Re-union of the Church, and because he refused to receive *Arius* into his Communion.

The Emperor, who wanted to know by himself, *Arius's* Sentiments, (who had rendered himself still more suspect to *Constantine*, ever since his Return to *Alexandria*, where he was endeavouring to propagate his Errors to the Scandal of the Orthodox, who had refused him the Entrance of their Churches) sent for him, and asked him if he consented to all that had been decreed in the Council of *Nice*. *Arius* answered without Hesitation, he did, and signed it that very Instant. The Emperor surprized at it, asked him to confirm his Signature by Oath, which he did

also. But *Nicephore*, l. 8. c. 51. assures, that for an Evasion in this Case, *Arius* had hid in his Bosom a Formule he had signed, which contained his impious Doctrine, and that on that he swore he believed sincerely and without Exception, what he had signed; after which he was sent to *Alexander*, Bishop of *Constantinople*, to be received into the Communion of the Church.—That Order was given on *Saturday*; therefore *Arius* expected to assist the next Day at the Assembly of the Faithful.

Accordingly the next Day, very soon in the Morning (according to *Rufinus*, l. 1. c. 2. *Sozom.* l. 2. c. 23. *Socr.* l. 1. c. 25. *Niceph.* l. 8. c. 51.) *Eusebius* accompanied with a vast Number of his Partisans, went to take *Arius* in his Chamber, which was in one of the Apartments of the Palace, to conduct him, as in Triumph thro' the City to the Great Church to have him received to the ecclesiastical Communion, in Presence of the People assembled to see the Ceremony. But he little thought that the Divine Justice was ready at Hand to stop the Course of his Crimes; for as he approached the Place of *Constantine*, where that Prince had erected a magnificent Column of Porphyry, he was suddenly seized with a panick Fear, caused by the Image of his Perjury, and which was so violent, that finding himself forced to ease Nature, he went in Haste to a neighbouring publick Place, where he expired, voiding his Intestines with his Excrements. *Eusebius* who had been obliged to stop, having waited some Time, afraid that *Alexander* should seize the Church, sent some of his Attendants to hasten *Arius*; but to his Confusion, learned the deplorable Condition he had been found in.—The News of so fatal an Accident soon spread all over the World, and *Constantine* seemed very much pleased at it, and returned Thanks to God for having so clearly evidenced and confirmed the Council of *Nice*, in which he persisted to his Death, which happened soon after.

Socrates, l. 1. c. 26. *Sozomen*, l. 1. c. 32. *Rufinus*, l. 15. c. 11. *Eusebius*, l. 4. c. 53. assure us, that *Constantine* was in the thirty-second Year of his Empire, and in the sixty-fifth of his Age, when he found himself attacked with a violent Malady, which increased every Day; and that after he had used in vain the Hot-Bath of *Constantinople*, and those of *Helenopolis* in *Bithynia*, he had himself carried to *Acherona*, a Palace he had near *Nicomedia*; there as he perceived by his Distemper's increasing, that Death was near, he met it with the same Magnanimity, he had seen the most formidable Powers of the Earth at his Feet; he made his Will, and divided the Empire between his Children, granting several very considerable Privileges to *Rome* and *Constantinople*.—He intrusted with that Will, a Priest, who had been recommended to him by his Sister *Constantia*, and whom he had distinguished ever since by some singular Mark of his Favour; commanding him to deliver it to none but to his Son *Constantius*, to whom he had left the Empire of the *East*, and died a few Days after in the Absence of all his Sons.

After *Constantine's* Death, *Constantius* his Son, to whom he had left the Empire of the *East*, having been infected with *Arianism*, by *Eusebius* of *Nicomedia*, and the Priest whom *Constantine* had made the Depositary of his Will, suffered the Orthodox to be persecuted; and though *Athanasius* had been sent back to *Alexandria* by *Constantine*, who by the Emperor's Will had been made Master of Part of the Western Empire, he listened to the Tales and Calumnies forged against him by his antient and most inveterate Enemies the *Arians*. On those false Accusations *Constantius* had been inclinable enough to have banished *Athanasius* of his own Authority; but as he was afraid of his two Brothers *Constantine* and *Constans*, whom he knew favoured the Patriarch; to do it with some Appearance of Justice, he had Recourse to the intriguing *Eusebius*, who persuaded the Bishops his Partisans to send a Deputation to *Rome*, to carry to the Pope, and to the two Emperor's of the *West*, the

new Accusations which had been intended by them against *Athanasius*.—The Patriarch, who was soon informed of this Determination of the *Arians*, assembled a Synod at *Alexandria*, of all the Bishops depending of his Patriarchate; who having consulted together on that Affair, wrote an excellent synodal Letter to the Pope, and to all the Catholick Bishops throughout the whole World, containing a Justification of *Athanasius's* Conduct, and an exact Refutation of all the old and new Impostures, wherewith the *Arians* had attempted to blacken and distress his Innocence. Saint *Athanasius* himself assures us, in his Letter *ad Solitarios*, that the Affair was soon concluded before *Constantine* and *Constans*, who having discovered by the Answers of the Priests of *Alexandria*, sent by *Eusebius* and his Party, the Weakness and Impudence of the Accusers, had them shamefully banished from their Presence.

The *Eusebians* met with more Credit at *Rome*; for Pope *Julius*, who had succeeded *Marcus* in that See, willing to observe some Formalities in the Decision of that grand Affair, had a Council assembled at *Rome*; where *Athanasius*, and his Adversaries, were cited; *Athanasius* obeyed the Citation, and was received by the Pope, with great Marks of Distinction and Respect. *Baronius ad An. 340. n. 11.* says, That it was then he composed his admirable Symbol which he presented to the Pope, as a Confession of Faith. That excellent Piece was deposited in the Archives of the *Roman Church*, together with the Acts of the Council; and as it was found a long while after, and when it was thought quite lost, it was judged proper, in Honour to the Memory of so great a Man, to render it publick, by inserting it in the Liturgy, as the most perfect Expression of the Catholick Faith, against the Impiety and Blasphemies of *Arianism*.

The *Eusebians*, who had no Design to come to *Rome*, after they had amused the Pope, for a whole Year, under some frivolous Pretences and Excuses, assembled to the Number of ninety in a Council, by *Constantius's* Order, which *Eusebius*, heretofore of *Nicomedia*, then of *Constantinople*, had procured.—The Case of *Athanasius*, though it had been referr'd to the Pope's Decision, was the first Thing agitated in that Council; the chief Point of the Accusation against him, was the same which had been carried to the Pope, and to the two Emperors of the *West*, to which were added, says *Sozomen*, *l. 3. c. 5.* the supposed Crimes for which he had been deposed at *Tyre*; and was again deposed anew.—They proceeded afterward to form a Confession of Faith, which might be received by the whole Christian World; wherein, after they had protested, that far from being *Arians*, they had themselves the most contributed towards *Arius's* Conversion; They professed, 'one only God, Creator of all Things, and his only Son, who has been, with his Father, before all Ages, and by whom all Things have been made, and who will be King and God for evermore.'—But when they began to consider that this Formule, so different from that of *Nice*, would render them suspected, they formed another a few Days after, which by the numerous Praises they gave to the Son of God, was enough to have surprized and deceived the whole Christian World; for they added to that Formule, besides all the Titles of Honour given by the Scripture to the Son of God, That 'they believed him God according to the Gospel, which says, and the Word was God; that he was incapable of Mutation, the Image of the Divinity, of the Essence, and Glory of his Father, without any Difference; and at last that they confessed the Father, the Son, and the Holy Ghost, three distinct Persons, and who are but one in Sentiment and Will.'—Afterward they anathematized those who should say, 'That there has been some Moment when the Word was not yet begotten by the Father, or that he is like one of his Creatures.'—This is certainly Orthodox, when very well understood in the

Sense of the Scripture; and therefore they repented soon that they had said so much, by confessing that he was the Image of the Substance and of the Divinity with the Father, without any Difference, *απαρραλλαντος εικονα*: Therefore they chose a third Profession of Faith, which was proposed by *Theophranius*, Bishop of *Tyanea*; in which, confessing that the Word was the only Son of God, begotten of his Father before the Time, perfect God of a perfect God, they suppressed, as in the First, the Words *ομοουσιος ομοουσιος*, Essence and Substance.

The *Eusebians* deputed four of their own Party, to carry this Confession of Faith, together with Letters against *Athanasius*, to the Emperor *Constantius*.—While they were thus triumphing over *Athanasius*, the Bishop of *Rome*, *Julius*, who knew nothing of their pretended Council at *Antioch*, had assembled one at *Rome* of more than fifty Bishops, where, the Acts of *Tyre* having been carefully examined, and *Athanasius* heard in his Defence, his Innocence was declared in that Synod, by a canonical Judgment, *Julius* received him into his Communion, and at his Table, and sent him to his Church to oppose all that his Enemies could undertake against his Authority during his Absence.

Eusebius having learned what had been done at *Rome* against him and his Party, dismissed the Pope's Legates, and wrote very insolent Letters to *Julius*; in which, without making the least Mention of what had happened in his Council at *Antioch*, he complained that he undertook to examine an Affair which had been decided already in a Council: He added, on purpose to insult him, that he should have wrote to him in another Manner than he had done, contenting himself with a single Letter for all; that though he was Bishop of a greater City, he was not however greater in Dignity; and that he should not have received into his Communion, those who had been condemned by other Bishops.—Afterwards he persuaded *Constantius*, that his Authority was compromised in that Affair; that it was a Point of his Honour to maintain an Election which had been made in his Presence, (meaning that of *Gregory*, whom they installed Bishop of *Alexandria*, in St. *Athanasius's* Place,) and that he ought not to suffer so bold an Enterprize of the Bishop of *Rome* in his Empire; but on the contrary gave Orders that *Gregory* should be re-established in the See of *Alexandria*; which *Athanasius* himself in his Epistles *ad Solitarios* informs us, was executed, by the Emperor writing to *Philagrius*, Governor of *Egypt*, that he was sending *Gregory* with Troops to take Possession of the See of *Alexandria*, that he must have his Orders published, to establish him, and all those punished who should presume to oppose it; and afterwards sending *Gregory* accompanied with 5000 Men of his best Troops, commanded by a Lieutenant General, and with *Arsacius* one of the chief Eunuchs of his Palace, to see his Orders executed.

That Troop of Banditti was no sooner arrived at *Alexandria*, but they began by attacking with Fire and Sword all the Churches, where they perpetrated all Sorts of Cruelties, Impieties and Sacrileges; in those holy Sanctuaries, all the Orthodox were inhumanly beaten or murdered; the Virgins were violated, and the Altars profaned, either by the Jews, who came thither to renew the Rage and Blasphemies of their Ancestors, or by the Gentiles, who sacrificed Birds and Fruits to their Idols; the Bishops themselves who were then at *Alexandria* were not spared, for some of them were cruelly beaten, and others imprisoned. And the glorious Confessor of Christ *Potamon*, the most strenuous Asserter of the Faith of *Nice*, received then by *Gregory's* Orders, so many Blows upon his Head, that he was left for dead upon the Place, and died a few Days after, receiving then the Crown of Martyrdom, which *Maximinus* had refused him, by contenting himself with only depriving him of one of his Eyes.—But however *Gregory* and *Philagrius* had not the cruel Satisfaction they expected of seizing *Athanasius*,

nasius, who had the good Fortune to escape their Rage, by hiding himself during that violent Tempest, and afterwards fled to *Rome*, with those of his Priests who were not fallen in the Persecution.—In the Interim, *Eusebius* the greatest of *Athanasius's* Enemies died.

Pope *Julius*, and *Constantius* Emperor of the *West*, the better to remedy all those Disorders caused in the Oriental Church by the *Arians*; with the Consent of *Constantius* Emperor of the *East*, to whom he had wrote on that Subject, assembled a Council of more than three hundred orthodox Bishops at *Sardick*.—On the other side the *Eusebians* to the Number of very near eighty, came also to *Sardick*.—At the Opening of the Council, the Cause of *Athanasius* having been examined, he was declared Innocent, and re-establish'd in his See, to the general Applause of the whole Assembly, who admired his Constancy; and the Accusations and the Proofs produced by the Bishops present, and by the Deputies of several Towns and Churches, against the *Arians*, having been examined likewise; their Chiefs, *Theodorus* of *Heraclea*, *Stephen* of *Antioch*, *Acacius* of *Cæsarea*, *Menophantes* of *Ephesus*, *Acacius* of *Singidunum*, *Valens* of *Mercia*, &c. were excommunicated.—There was nothing done in this Council with relation to the Faith, which was ordered to be kept, such as was contained in the Symbole of *Nice*.—The *Arians* on their Side having deserted the Council of *Sardick*, assembled at *Philippopolis*, where they condemned the Term *Consubstantial*.—These two opposite Councils having been brought to a Conclusion, the Bishops on both Sides retired to their respective Churches.

Constantius Emperor of the *West*, took Care to inform *Constantius* of what had been concluded in the Council of *Sardick*, and desired him to restore *Athanasius* to his See; but perceiving that *Constantius* little minded his Request, he gave him the Choice, either to restore *Athanasius*, or to expect to have him for an Enemy.—This Declaration caused some Inquietude to *Constantius*, therefore he sent for some Bishops to advise with them on the Choice offered by the Emperor his Brother. They answered it was better to grant his Church to *Athanasius*, than to enter into a civil War; so that *Constantius* recalled him, as being forced to it by an indispensable Necessity; but *Athanasius* fearing his Calumniators, and uncertain if he should trust to *Constantius's* first Letter, he receiv'd, says *Socrates*, a second and a third.

Athanasius having received those Letters at *Aquileia*, where he had retired ever since his Departure from *Sardick*, went to *Rome*, shewed them to *Julius*, and filled the *Roman* Church with Joy, who was in Hope that *Constantius* was on the Point of embracing the orthodox Faith, since he recalled *Athanasius*. *Julius* wrote in his Favour to the Clergy and to the People of *Alexandria*; and he was favourably receiv'd of *Constantius*, whom he found at *Antioch*. But as his Life was to be a continual Fluctuation of Prosperities and Adversities, and he had always in the *Arians*, a formidable Party to encounter with, the Intervals between his Deposition and his Restoration were never very long; they always formed fresh Accusations against him, and always gave false Interpretations to his most righteous Intentions; even at this Time of his Return to his Patriarchate with the Emperor's Consent, he was accused of having usurped on his Passage to *Alexandria*, a despotick Power, by ordaining Priests and Deacons out of his Diocess, contrary to the Canons; with having assembled a Council at *Jerusalem*, with no other Design than to excite Troubles in the Empire, with several other pretended Crimes; which so much irritated *Constantius*, that he ordered he should be put to Death, which Danger *Athanasius* escaped by flying to the Desert, where he hid himself, shifting often his Solitude for Fear of a Discovery.—Some Time after, the Bishops of the occidental Church having assembled at *Milan*, to the Number of very near 300, among whom, there

were also some few of the oriental Church, these asked for a Sentence against *Athanasius*, whereby he should be excluded for ever from *Alexandria*, which was opposed by *Paulinus* Bishop of *Treves*, *Denis* Bishop of *Albe*, and *Eusebius* Bishop of *Vercel*, who insisted that such Proposition was made with no other Design than to ruin the Faith, by the Sentence which was proposed to be pronounced against *Athanasius* who was innocent.—The Emperor having been informed of what had passed at *Milan*, banished these three Bishops, and wanted to assemble both Churches in *Italy*, in Order to re-unite them all if possible, in the same Sentiment; but having reflected afterwards on the Difficulty of travelling, he ordered that those who were in *Italy* should assemble at *Rimini*, and the oriental Church at *Nicomedia*. But a frightful Earthquake having happened at *Nicomedia*, while the Bishops were yet upon the Road, the Council was removed to *Seleucia*; but the *Arian* Bishops who were at *Sirmium*, at the Emperor's Court, assembled, says *Sozomen*. l. 4. c. 15. the 22d of May, 351, to draw up a Formule to be presented to both Councils, and where they were a considerable Time before they could agree together; for they would all have rejected the Term *ομοουσιον*, *Consubstantial*; and *Basileus* of *Ancyra*, would have had inserted in the Formule, *ομοιουσιον*, that the Son was *semblable in Substance* to his Father; on the contrary, *Valens* wanted to have both Terms rejected; so that the Dispute being likely to last long, and the Emperor commanding them to agree on that Subject, they were obliged to chuse one among them, viz. *Marcus* of *Arethusa*, to draw up a Formule, which the others should be obliged to sign, who accordingly took a Medium betwixt both Opinions, which though not very agreeable to either Party, they were however obliged to accept.—*Marcus*, to please *Valens*, had inserted among other Things in his Formule, that in speaking of God and of his Son, the Term *Substance* should be abolished; because it caused a Scandal in the Church, and the Scripture makes no Mention of it; and to oblige *Basileus*, he confessed that the Son is *semblable* to his Father in all Things.—This is the ninth Formule of the *Arians*, ever since the Beginning of their Heresy.

We learn from *Epiphanius*, *Heres*. 73. That when they were all called to sign in Presence of the Emperor, *Valens* after he had made a short Discourse to shew how he consented to that Formule, wrote that he believed the Son *semblable* to his Father without adding *κατα παντα*, in all Things; but *Constantius* insisting he should do it, he obeyed seemingly without Reluctancy.

On the other Side, *Basileus* of *Ancyra* was not pleased that the Term *Substance* should be excluded, knowing very well that *Valens* would in Time give his own Sense to the Formule; therefore protested when he signed the Formule, that by these Words, *semblable in all Things*, he understood a perfect Similitude, not only according to the Will, but likewise according to the very Being; which however was not inserted in the Formule, to which this Title was given *ὡς κατὰ τὸ εἶναι*. *Exposition of the Catholick Faith, made in the Presence of the most religious and victorious Emperor Constantius eternal, august, under the Consulate of Eusebius and Hypatius, the 11th of the Calends of June*; which made *Athanasius* laugh at the *Arians*, who by marking the Year and the Day, contrary to the Custom observed in Professions of Faith, shewed plainly the Novelty of their Beliefs, born precisely at that Time; besides that they were not ashamed to give a Man the Title of *Eternal*, which they refused to the Son of God; though they confessed in the Formule, that he was before all Times; but it was to please *Basileus*, who believed him such, and who was at that Time in great Favour near the Emperor.

But however the Formule being accepted by both Parties, at least for a Time, *Valens* took it to carry it to *Rimini*, and *Basil* to *Seleucia*, where the oriental Bishops had assembled, to the Number of 160, according to *Severus*, l. 2. or 150, according to *So-*
D d d
crates,

crates, l. 2. c. 39. *Leonas*, one of the chief Officers of the Emperor, was ordered to be present at all their Disputes and Deliberations.—The Bishops having assembled the 27th of *September*, *Leonas* ordered that every one of them should propose what he thought proper, the Bishops who were present were of Opinion that no Question should be debated 'till the Arrival of those of their Brethren, who were expected. Those were *Macedonius*, Bishop of *Constantinople*, *Basileus* of *Ancyra*, with some others, who were detained in their Dioceses by the Apprehension of being accused of several Crimes they knew themselves guilty of. But however *Leonidas* insisting they should begin, the Bishops answered, that they would not enter into any Discussions of Matters of Faith, before they had examined the Life and Conduct of those who were accused of Crimes, as *Cyrillus*, Bishop of *Jerusalem*, *Eustatius*, Bishop of *Sebastie* in *Armenia*, and some others. There arose on that Subject a very great Contestation, and the Bishops finding it was impossible they should agree, divided themselves into two Parties. *Acacius*, Bishop of *Cæsarea* in *Palestina*; *Georgius*, Bishop of *Alexandria*; *Uranus*, Bishop of *Tyre*; and *Eudoxius*, Bishop of *Antioch*; followed only by thirty others, were the Chiefs of one; and *Georgius*, Bishop of *Laodicea* in *Syria*; *Sophronius*, Bishop of *Pompeipolis* in *Paphlagonia*; *Eleusius*, Bishop of *Cyzick*, of the other Party, which was certainly the most numerous.

This last Party, which was for examining the Doctrine first, having prevailed, the other thought they should abolish the Faith of *Nice*, and introduce another. The prevailing Party found nothing amiss in the Council of *Nice*, but the Term *CONSUBSTANTIAL*. The Bishops having disputed with great Warmth, 'till the Evening, *Sylvanus*, Bishop of *Tarse*, raising his Voice, said that there wanted no new Formule of Faith; but that they should retain that formed and agreed upon at *Antioch*; he had no sooner pronounced these Words, but the Partisans of *Acacius* went out of the Assembly.—The Bishops of the other Party read the Formule decreed at *Antioch*, and then parted. The next Day they met in the Church, and having ordered the Doors to be shut, signed the same Formule; Deacons and Readers signed in the Place of the absent Bishops.

Acacius, and those of his Party, finding Fault with the Gates of the Church being shut, declared that a Signature thus made in Secret was to be suspected; though this Bishop had no other Design in that than to have another Formule of Faith he had prepared, received. Nothing else was done that Day.—The third, *Leonas* ordered that the Bishops of both Parties should assemble. *Macedonius* of *Constantinople*, *Basileus* of *Ancyra*, and some others, who had staid in the Suburbs of *Seleucia*, for Fear of their Enemies, came that Day to the Assembly, which being begun, *Leonas* told them that he had a Request, which had been presented to him by *Acacius*, which he thought proper to have read, to which the whole Assembly consented with Difficulty; but they were all surprized when, instead of a Request, they heard, by the Reading of it, that it was the Formule of the Faith of *Acacius*, in which he rejected *ομοουσιον*, *Consubstantial*, against the Orthodox; *ομοιουσιον*, *semblable in Substance*, against the *Semi-Arians*; *ανωμοσιον*, *dissemblable*, against the *Anomæans*, and confessed that the Son was semblable to his Father, but without adding *in all Things*, as in the Formule of *Sirmium*.—This Formule of *Acacius* was signed by him, and by the thirty-six Bishops, his Partisans, but the rest of the Assembly protested against it, which occasioned a Dispute, which lasted that Day and the next, with a great Deal of Obstinacy on both Sides, at which *Leonas* was so provoked, that he left abruptly the Assembly; and when the next Day he was desired to return to it, he answered that he had been sent by the Emperor to assist at a Council, where the Bishops were to agree amongst themselves; but since they would not do it, that they

might go, if they pleased, and chatter and play in the Church without him.—The Partisans of *Acacius* taking Advantage of this Answer refused also to come to the Council.—The Bishops of the other Party having assembled, sent for *Acacius* to examine the Affair of *Cyrillus*, Bishop of *Jerusalem*, accused of some Crime or other, and had even been deposed, because having been cited for two Years together, he had always refused to appear. He nevertheless sent a Writing to those who had deposed him, by which he appealed to a greater Council, and the Emperor *Constantinus* had approved his Appeal. The Bishops taking this Refusal of the *Acacians* for a Sort of Conviction of the Crimes laid to their Charge, pronounced against them the Sentence of Deposition, and sent to the Emperor to inform him of it; but the *Acacians* arrived before their Deputies at *Constantinople*, where the Emperor was come from *Sirmium*. They soon persuaded him that *Basileus* of *Ancyra*, and those of his Faction had hindered the Peace, which was to be made in the Church on the Formule digested in Concert in his Presence at *Sirmium*. On which the Emperor, with *Acacius's* Advice, ordered that a Synod should be immediately called, of the neighbouring Bishops, at which were present the ten Deputies of the Council of *Seleucia*. *Acacius* in that Council framed another Formule of Faith, which was the 11th, and in it they rejected not only the *Consubstantial*, and the *Semblable in Substance*, as in the third of *Sirmium*, but likewise the *Hypostasis*, or the Person, mentioning only that the Son was *God of God*, semblable to the Father, by whom he was begotten, without adding to it *in all Things*.

While the *Arians* were holding their two Concilia-bles of *Seleucia* and *Constantinople*, they celebrated that in *Italy*, composed of more than four hundred Bishops, to whom *Valens* presented the third Formule of *Sirmium*, intimating that it was the Emperor's Will they should accept it such as it was, without disputing any more on our Mysteries, or introducing unknown Terms or new Expressions, which caused all the Trouble and Scandal.—The Council having examined the Formule, and asked for the Suffrages, *Valens* was answered, says *Athanasius*, lib. de Synod. that 'the Fathers had not assembled to learn, a new, ' what they were to believe, since by the Grace of ' God they professed the true Faith, but only to con- ' found and condemn those who attempted to cor- ' rupt it by their Novelties; that they ought then to ' join with them to condemn, by an unanimous Con- ' sent, all the Heresies begun by *Arianism*, which ' could not be done otherwise, than by following in- ' violably the Decisions of the Fathers of *Nice*, who ' had declared in their Symbole all that could be said ' or believed on the Points in question.'—But *Valens* and his Partisans protested publicly they would never agree to it, for which they were declared Hereticks by the Council and excommunicated. To this Declaration and Excommunication they added *Anathema's* against the Doctrine of *Arius* to a certain Number of Propositions, and afterwards sent ten Deputies to *Constantinus* with Letters, by which after they had exposed to him the Reasons of the Sentence they had pronounced, they desired him to give the necessary Orders for their Return, and to observe religiously what the Church had determined, under the Empire of the great *Constantine*, without obliging them any more to quit their Churches, to meet in Councils, which after that of *Nice* were needless.

But these salutary Exhortations had no good Effect on *Constantinus's* Mind, always besieged by the *Arians*, who had a very great Ascendant over him, and used to make him do whatever they pleased. And *Arianism*, instead of being abolished or extinct by the strong and frequent Oppositions it met with from the Orthodox, has perpetuated itself throughout all Ages, even so far as our own Times, where there have been, and are yet found several strenuous Asserters of the impious Doctrine of *Arius*. Therefore, I think it
needless

needless to proceed farther in this Historical Account of that Heresy, since what I could say more on that Subject, would be nothing else but a Repetition of the same Dogma's, perhaps disguised under different Forms, and accompanied with Seditions, Persecutions,

Ravages, and Disorders, which have always been the constant Companions of all Sorts of Heresies, whose Property is to lacerate Christ's seamless Gown, and to oppress Piety, Virtue, and Orthodoxy.

ARITHMETICK.

ARITHMETICK is the Art of numbering; or that Part of Mathematicks which considers the Powers and Properties of Numbers; and teaches how to compute and calculate truly, and with Expedition and Ease.

Some Authors choose to define *Arithmetick* the Science of *discrete Quantity*; which *discrete Quantity* is that, which is not continued and joined together, such is a Number whose Parts, being distinct Units, cannot be united into one *Continuum*; for in a *Continuum* there are no actual determinate Parts before Division, but they are potentially infinite; wherefore it is usually and truly said that continued Quantity is divisible *in infinitum*.

But as in our Definition we have mentioned *Numbers*, and *Numbers* is the Subject of *Arithmetick*, we must previously to all other Observations on this Subject, consider what is a Number.

NUMBER in *Arithmetick* is a Collection or Assemblage of several Units, or several Things of the same Kind; and an Unit is the *Number One*; or one single individual Part of *discrete Quantity*.

Sir *Isaac Newton* conceives *Numbers* to consist, not in a Multitude of Units, as *Euclid* defines it, but in the Abstract *Ratio*, of a Quantity of any Kind, to another Quantity of the same Kind, which is accounted as Unity, and on this View he divides *Number* into three Kinds, *viz.* *Integers*, *Fractions*, and *Surds*, which three Kinds are to be considered, each in its proper Place.

The Schoolmen keeping to *Euclid's* Definition, hold *Number* to consist of Matter and Form: The *Matter* is the Thing numbered; *e.g.* Coin; the *Form*, the Idea whereby comparing the several Pieces, we bring them into one Sum, as *Ten*: So that *Number* depends altogether on the Mind of the Person that numbers; whence changing the Idea at Pleasure, an hundred Men shall only be called one, or it shall be two or four, &c.—Hence, say they, the Form of a *Number* is not any Thing added to the Thing numbered; for the Idea is a mere Mode of the Mind, not any Thing super-added to the Things.—And hence, though there may be some Efficacy in *Number*, considered with Respect to the Matter, as when we say a triple Rope is not easily broke; yet there is none in Respect to Form: For what Alteration should my Idea make? And hence the Folly of the Philosophy of *Numbers*.

The Characters whereby *Numbers* are ordinarily expressed, are the nine following ones, *viz.* 1, 2, 3, 4, 5, 6, 7, 8, 9, it being the Law of common *Numeration*, that when you are arrived at Ten, you begin again, and repeat as before; only expressing the *Number* of Tens.

Now to express any written *Number*, or assign the proper Value to each Character; divide the proposed *Number* by Comma's into Classes, allowing three Characters in each Class; beginning at the Right Hand.—Over the Right Hand Figure of the third Class add a small Mark, or transverse Line; over the Right Hand Figure of the fifth Class add two Marks or transverse Lines; over that of the seventh, three, &c.—The *Number* to the Left of the first Comma expresses by Thousands; that which has over it the first transverse Line, expresses by Millions; that with two, by Billions; that with three, by Trillions, &c. Lastly, the Left Hand Character of each Class expresses by Hundreds; the middle one by Tens; and the

Right Hand one by Units.—Thus will the *Numeration* be effected; *e.g.* the following *Numbers*, 2^{'''}, 125,473^{''}, 613,578['], 432,597, are thus expressed or read: Two Trillions, one hundred twenty-five Millions of Billions, four hundred seventy-three Billions, six hundred thirteen thousands of Millions, and five hundred seventy-eight Millions, four hundred and thirty-two Thousand, five hundred and ninety-seven.

Arithmetick consists chiefly in the four great Rules or Operations, of *Addition*, *Subtraction*, *Multiplication* and *Division*. It is true, for the facilitating and expediting of Computations, Mercantile, Astronomical, &c. divers other useful Rules have been contrived; as the Rules of *Proportion*, of *Alligation*, of *False Position*, *Extraction of Square and Cube Roots*, *Progression*, *Fellowship*, *Interest*, *Barter*, *Rebate*, *Reduction*, *Tare and Tret*, &c. But these are only Applications of the first four Rules; which before I can pretend to demonstrate, I must explain what's meant by *Rule*.

RULE in *Arithmetick*, denotes a certain Operation with Figures to find Sums or *Numbers* unknown; and to facilitate *Computations*, *Mercantile*, *Astronomical*, &c. Each *Rule* has its particular Name, according to the Use for which it is intended. The four first abovementioned serve as the Foundation of the whole Art; and the first and easier is *Addition*.

ADDITION consists in finding the Amount of several *Numbers*, or Quantities, severally added one to another. The *Numbers* thus found are called the *Sum* or Total of divers *Numbers* put together, as 5 and 7 are 12, as also the Sum of 7, 4, and 11 put together, are 22. And this is called *Addition* of simple *Numbers*, which is very easy.

In longer or compounded *Numbers* the Business is performed by writing the given *Numbers* in a Row downward, that like Places or Degrees in Each *Number* may stand in the same Rank; that is Units under Units, Tens under Tens, Hundreds under Hundreds, Thousands under Thousands, &c. and singly collecting the Sums of the respective Columns.

To do this we begin at the Bottom of the utmost Row to the Right, and if the Amount of this Column do not exceed 9, we write it down at the Foot of the same Row or Column: If it do exceed 9, the Excess is only to be wrote down, and the rest reserved to be carried to the next Row, and added thereto, as being of the same Kind or Denomination.

Suppose, *e.g.* the *Numbers* 1357, and 172, were given to be added; write either of them, *v.g.* 172, under the other 1357; so as the *Units* of the one, *viz.* 2, stands under the *Units* of the other, *viz.* 7, and the other *Numbers* of the one, under the correspondent one of the other, *viz.* the Place of Tens under Tens, as 7 under 5; and that of Hundreds, *viz.* 1, under the Place of Hundreds of the other, 3. Thus,

$$\begin{array}{r} 1357 \\ 172 \\ \hline 1529 \end{array}$$

Then beginning, say, 2 and 7 makes 9, which write underneath. Also 7 and 5 make 12; the last of which two *Numbers*, *viz.* 2 is to be written, and the other 1 reserved in your Mind, to be added to the next Row, 1 and 3: then say 1 and 1 makes 2, which

which added to 3 make 5; this write underneath, and there will remain only 1, the first Figure of the upper Row of Numbers, which also must be writ underneath; and thus you have the whole Sum, viz. 1529.

So to add the Numbers 4607, 8628, 6845, 3130 into one Sum, the Operations will stand as followeth,

$$\begin{array}{r} 4607 \\ 8628 \\ 6845 \\ 3130 \\ \hline 23210 \end{array}$$

The Figures in the first Row making 20, I set down 0 under the first Row and carry 2 to the next, which makes 11, I set down 1, and carry one to the third Row, which making 22, I set down 2, the Excess, and carry two to the fourth Column; which said 2, and the Figures in the fourth Column making 23, I set all down towards the left Hand of the Figures before subscribed; so the Sum of the four Numbers put together are 23210.

To prove your *Addition* after you have added up your whole Sum, draw a Line with your Pen under the uppermost Number, and when you have so done, add all the other Numbers, except the uppermost; and when you have so done, add the Amount or Sum thereof to the uppermost Sum above the Line; and if the Sum be the same with the Sum first found, your Work is true, otherwise not *e. g.*

$$\begin{array}{r} 56 \\ \hline 23 \\ 91 \\ 74 \\ 45 \\ 67 \\ \hline 356 \\ \hline 300 \\ \hline \text{Proof } 356 \end{array}$$

Addition of Numbers of different Denominations, for Instance, of Pounds, Shillings, and Pence, is performed by adding or summing up each Denomination by itself, always beginning with the lowest; and if after the *Addition* there be enough to make one of the next higher Denomination; for Instance, Pence enough to make one or more Shillings, they must be added to the Figures of that Denomination, that is to the Shillings; only reserving the odd remaining Pence to be put down in the Pence Place, and the same Rule is to be observed in Shillings, with Regard to Pounds.—*v. g.* 5 Pence and 9 Pence make 14 Pence; now in 14 there is once 12, or a Shilling, and two remaining Pence; the Pence I set down, and reserve one Shilling to be added to the next Column which consists of Shillings.—Then 1 and 8, and 2 and 5, make 16; the 6 I put down, and carry the 1 to the Column of Tens; 1 and 1 and 1 make three Tens of Shillings, or 30 Shillings; in 30 Shillings there is once 20 Shillings, or a Pound and 10 over; I write 1 in the Column of Tens of Shillings, and carry one to the Column of Pounds, and continue the *Addition* of Pounds according to the former Rules, thus,

$$\begin{array}{r} l. \quad s. \quad d. \\ 120 \quad 15 \quad 9 \\ 65 \quad 12 \quad 5 \\ 9 \quad 8 \quad 0 \\ \hline 195 \quad 16 \quad 2 \end{array}$$

so half of an even Sum will be carried to the Pound; and the odd one (where it so happens) set under the Tens of the Shillings.

Where there are Farthings you must begin with Farthings first: As for Example,

$$\begin{array}{r} l. \quad s. \quad d. \quad f. \\ 46 \quad 13 \quad 4 \quad \frac{1}{2} \\ 27 \quad 17 \quad 7 \quad \frac{1}{2} \\ 36 \quad 2 \quad 3 \quad \frac{3}{4} \\ 10 \quad 6 \quad 9 \quad \frac{1}{2} \\ \hline 121 \quad 00 \quad 1 \quad 0 \end{array}$$

In which *Rule*, beginning with Farthings first, I find 8 Farthings, which is two Pence, therefore I set down 0 in the Farthings, and carry the two Pence to the Pence, which with the Number of Pence, as 9, 3, 7, 4, makes 25 Pence, which is two Shillings and one Penny, so setting down the 1 Penny, I carry two to the Shillings; saying 2 that I carry and 6 is 8, and 8 and 2 is 10, and 7 is 17, and 3 is 20; so I set 0 in the Units Place of Shillings, and carry 2 Tens to the Tens Place, which with 2 Tens more makes 4 Tens or two Pounds, which said 2 Pounds I carry to the Pounds Place, saying 2 and 6, and 7 and 6 is 21, so I set down 1, and carry 2 to the last Place of Pounds, which with 1, 3, 2, 4, makes 12, and by setting down 12 in the same Line or Row; so the whole Work is finished, and I find the Sum to be 121 *l.* 00 *s.* 1 *d.* 0 *q.*

To prove the *Addition* after you have cast up your whole Sum, draw a Line under the uppermost Number or Sum, as before directed in your *Addition* of simple Numbers.

For an *Addition of Aver-dupois-weight*, you must observe that 16 Drams make an Ounce, 16 Ounces a Pound, 28 Pounds make a Quarter of an Hundred-weight, four Quarters make a Hundred-weight (consisting of 112 Pounds) and 20 Hundred is a Tun *Aver-dupois Weight*. For Example.

$$\begin{array}{r} \text{Tuns} \quad \text{Cwt.} \quad \text{qrs.} \quad \text{lb.} \\ 20 \quad 4 \quad 28 \\ 5 \quad 16 \quad 2 \quad 15 \\ \hline 2 \quad 10 \quad 1 \quad 12 \\ 7 \quad 14 \quad 0 \quad 20 \\ 4 \quad 9 \quad 1 \quad 9 \\ 6 \quad 5 \quad 2 \quad 10 \\ 3 \quad 7 \quad 3 \quad 2 \\ \hline \text{Sum } 30 \quad 3 \quad 3 \quad 12 \\ \hline 24 \quad 7 \quad 0 \quad 25 \\ \hline \text{Proof } 30 \quad 3 \quad 3 \quad 12 \end{array}$$

For *Troy-weight* observe that 24 Grains make a Penny-weight, 20 Penny-weights an Ounce, and 12 Ounces a Pound *Troy*. For Example,

$$\begin{array}{r} lb. \quad Oz. \quad Pwt. \quad Gr. \\ 12 \quad 20 \quad 24 \\ 24 \quad 9 \quad 6 \quad 11 \\ 164 \quad 10 \quad 14 \quad 18 \\ 82 \quad 7 \quad 17 \quad 20 \\ 8 \quad 8 \quad 18 \quad 22 \\ \hline \text{Sum } 281 \quad 00 \quad 17 \quad 23 \end{array}$$

For *Apothecaries-weight*, 20 Grains make a Scruple, 3 Scruples one Dram, 8 Drams one Ounce, 12 Ounces one Pound.

$$\begin{array}{r} lb. \quad Oz. \quad Drs. \quad Scr. \quad Gr. \\ 12 \quad 8 \quad 3 \quad 20 \\ 4 \quad 9 \quad 5 \quad 1 \quad 13 \\ 3 \quad 7 \quad 2 \quad 0 \quad 10 \\ 2 \quad 4 \quad 3 \quad 2 \quad 8 \\ 5 \quad 3 \quad 4 \quad 1 \quad 12 \\ \hline \text{Sum } 16 \quad 1 \quad 0 \quad 0 \quad 3 \end{array}$$

In *Cloth-measure*, 4 Nails make one Quarter of a Yard,

Yard, 4 Quarters one Yard, 5 Quarters an Ell *Englsh*, and 3 Quarters an Ell *Flemish*.

In *Land-measure* 40 square Poles or Perches, make a Rood, and 4 Roods make an Acre, *e. g.*

	4	4
<i>Yds.</i>	<i>Quart.</i>	<i>Nails.</i>
27	2	3
14	1	2
96	0	1
75	1	0
23	3	3
<hr/>		
237	1	1

	4	40
<i>Acres.</i>	<i>Roods.</i>	<i>Perch.</i>
120	2	34
275	3	14
162	1	35
98	2	20
47	3	30
64	1	15
<hr/>		
769	2	28

	5	4
<i>Ells Eng.</i>	<i>Quart.</i>	<i>Nails.</i>
36	3	2
27	4	0
75	2	3
56	3	1
92	1	0
<hr/>		
288	4	2

Addition of Decimals is performed after the same Manner as that of whole Numbers; as may be seen in the following Example,

$$\begin{array}{r} 630.953 \\ 51.0807 \\ 305.27 \\ \hline 987.3037 \end{array}$$

In *Wine-measure*, two Pints make a Quart, 2 Quarts a Pottle, 2 Pottles 1 Gallon, 42 Gallons a Tierce, or third Part of a Pipe or But, 63 Gallons a Hogsh-head, 2 Hogshheads a Pipe or But, and two Pipes or Buts make a Tun of Wine, *v. g.*

	2	63	8
<i>Tuns</i>	<i>Hbds.</i>	<i>Gall.</i>	<i>Pts.</i>
45	1	9	7
21	0	7	1
72	0	8	2
53	0	12	5
97	1	6	3
69	0	5	1
16	1	10	4
<hr/>			
374	1	59	7

From *Addition* we'll proceed to *SUBTRACTION*, which is the second *Rule*, or rather Operation in *Arithmetick*; whereby we deduct a less Number from a greater, to learn the precise Difference.—Or more justly, *Subtraction* is the finding a certain Number from two homogeneous ones given; which with one of the given Numbers, is equal to the other.—The Doctrine of *Subtraction* is reducible to what follows.

To *SUBTRACT* a less Number from a greater.—
1. Write the less Number under the greater, in such Manner that homogeneous Figures answer to homogeneous, *i. e.* Units to Units, Tens to Tens, &c. as directed above, under *Addition*—2. Under the two Numbers draw a Line.—3. *Subtract* several Units from Units, Tens from Tens, Hundreds from Hundreds; beginning at the right Hand, and proceeding to the left; and write the several Remainders in their correspondent Places under the Line.—4. If a greater Figure come to be subtracted from a less; borrow one Unit from the next left Hand Place; this is equivalent to 10, and added to the less Number, the *Subtraction* is to be made from the Sum: Or if a Cypher happen to be in the next left Hand Place, borrow the Unit from the next further Place.

By these Rules, any Number may be subtracted out of another greater. For Example.

$$\begin{array}{r} \text{If it be required from } 9800403459 \\ \text{to subtract } 4743865263 \end{array}$$

the Remainder will be found 5056538196

For, beginning with the right Hand Figure, and taking 3 from 9, there remains 6 Units, to be wrote underneath the Line: Going then to the next Place, 6, I find, cannot be taken from 5, wherefore from the Place of Hundreds 4, I borrow 1, which is Equivalent to 10, in the Place of Tens; and from the Sum of 10 and 5, *viz.* 15, subtracting 6, I find 9 Tens remaining to be put down under the Line. Proceeding to the Place of Hundreds, 2, with the 1 borrowed at the last makes 3, which subtracted from 4, leaves 1.—Again 5 in the Place of Thousands, cannot be subtracted from 3; for which Reason taking 1 from 4, in the Place of Hundreds of Thousands, the Cypher is converted into 10 Tens of Thousands, whence one 10 being borrowed and added to the 3, and from the Sum 13 Thousand, 5 Thousand being subtracted, we shall have 8 Thousand to enter under the Line; then subtracting 6 Tens of Thousands from 9, there remains 3.—Coming now to take 8 from 4; from the 8 further on the left, I borrow 1, by means whereof, the two Cyphers will be turned each into 9.—And after the like Manner is the rest of the *Subtraction* easily performed.

E c c

If

It must be observed in this Place, that in *Wine-measure*, there is reckoned that 8 Gallons are a Firkin of Ale, 9 Gallons a Firkin of Beer, 2 Firkins a Kilderkin, and 2 Kilderkins a Barrel, 18 Gallons and a Half a Runlet.

In *Dry-measure* 2 Pints make a Quart, 2 Quarts a Pottle, 2 Pottles a Gallon, 2 Gallons a Peck, 4 Pecks a Bushel *Land-measure*, 5 Pecks 1 Bushel *Water-Measure*, 8 Bushels 1 Quarter, 4 Quarters 1 Chaldron, 5 Quarters 1 Wey.—36 Bushels is a Chaldron of Sea-Coal in *London*. For Example,

	4	8	4
<i>Chald.</i>	<i>Qrs.</i>	<i>Bush.</i>	<i>Pecks.</i>
48	3	5	2
12	1	4	0
91	2	3	1
74	0	6	0
67	1	1	3
52	3	4	2
49	2	1	1
<hr/>			
396	3	2	1

For *Long-measure*, 3 Barley-corns make 1 Inch, 12 Inches 1 Foot, 3 Feet 1 Yard, 5 Yards and a Half a Perch or Pole, 40 Perches makes 1 Furlong, 8 Furlongs 1 *English* Mile, 1760 Yards make a Mile, *e. g.*

	3	12	3
<i>Yds.</i>	<i>Feet</i>	<i>Inch.</i>	<i>Barl.</i>
326	2	10	1
127	1	9	0
414	2	7	1
732	0	11	0
256	1	1	2
514	0	10	1
937	2	3	0
<hr/>			
3310	0	4	2

If heterogeneous Numbers be to be subtracted from each other; the Units borrowed are not to be equal to ten; but to so many as there go of Units of the less Kind, to constitute an Unit of the greater. For Example,

<i>l.</i>	<i>s.</i>	<i>d.</i>
45	16	6
27	19	9
<hr/>		
17	16	9

For since 9 Pence cannot be subtracted from 6 Pence; of the 16 Shillings one is converted into 12 Pence, by which Means for 6 we have 18 Pence, whence 9 being subtracted there remain 9; in like Manner as 19 Shillings cannot be subtracted from the remaining 15; one of the 45 Pounds is converted into 20 Shillings from which, added to the 15, 19 being subtracted, the Remainder is 16 Shillings.— Lastly, 27 Pounds subtracted from 44 Pounds, there remain 17.

If a greater Number be required to be subtracted from a less, it is evident the Thing is impossible.— The less Number therefore, in that Case, is to be subtracted from the greater, and the Defect to be noted by the negative Character, *e. g.* If I am required to pay 8 Pounds, and am only Master of 3; when the 3 are paid there will still remain 5 behind; which are to be noted.—5.

Subtraction is proved by adding the Remainder to the Subtrahend, or Number to be subtracted; for if the Sum be equal to the Number whence the other is to be subtracted, the *Subtraction* is justly performed. For Example,

156	11	3	$\frac{1}{4}$
21	17	2	$\frac{1}{2}$
<hr/>			
134	14	0	$\frac{3}{4}$
<hr/>			
156	11	3	$\frac{1}{4}$

A few Examples more, will make this Rule plain.

	<i>l.</i>	<i>s.</i>	<i>d.</i>	<i>f.</i>
Received	100	10	9	$\frac{1}{2}$
Paid	67	14	10	$\frac{3}{4}$
<hr/>				
Due	32	15	10	$\frac{3}{4}$
<hr/>				
Proof	100	10	9	$\frac{1}{2}$

	<i>l.</i>	<i>s.</i>	<i>d.</i>	<i>f.</i>
Debtor	2101	12	7	$\frac{1}{4}$
Creditor	1097	15	10	$\frac{1}{2}$
<hr/>				
Ballance	1003	16	8	$\frac{3}{4}$
<hr/>				
Proof	2101	12	7	$\frac{1}{4}$

	<i>l.</i>	<i>s.</i>	<i>d.</i>	<i>f.</i>
Received	309	00	4	$\frac{1}{4}$
Disburst	217	19	6	$\frac{1}{2}$
<hr/>				
Rest	91	00	9	$\frac{3}{4}$
<hr/>				
Proof	309	00	4	$\frac{1}{4}$

If a Sum of Money be lent, and Payment thereof made at divers Times, and you would know what is due; in those Cases you must first add up the several Payments into one Sum, and subtract that Sum from the Sum lent, and the Remainder will shew what is due; an Example or two will make it easy and plain.

	<i>l.</i>	<i>s.</i>	<i>d.</i>
Received	1240	14	7
<hr/>			
Paid at several Times.	300	10	5
	249	16	9
	450	00	0
	100	10	6
	50	00	8
<hr/>			
Paid in all	1150	18	4
<hr/>			
Due	0089	16	3
<hr/>			
Proof	1240	14	7

	<i>l.</i>	<i>s.</i>	<i>d.</i>	<i>f.</i>
Received from the Bank	5240	17	9	0
<hr/>				
Paid unto several Men per Order, viz.	1000	12	6	0
	500	00	0	0
	329	10	4	$\frac{1}{2}$
	715	11	6	0
	870	05	0	0
	600	00	0	0
	519	10	7	$\frac{3}{4}$
	450	00	0	0
<hr/>				
Paid in all	4985	09	11	$\frac{3}{4}$
<hr/>				
Remains	0255	07	09	$\frac{1}{4}$
<hr/>				
Proof	5240	17	09	

Questions to exercise Addition and Subtraction.

Quest. 1. Two Persons *A.* and *B.* have two Sums of Money; *A.* has 3456 *l.* and *B.* 2195 *l.* 17 *s.* 4 *d.* what is the Difference?

	<i>l.</i>	<i>s.</i>	<i>d.</i>
	3456	0	0
	2195	17	4
<hr/>			
<i>Answer.</i>	1260	2	8

Quest. 2. Two Persons are of different Ages, *A.* and *B.* the Age of *A.* is 65, the Difference of their Ages is 34, what is the Age of *B.*?

	65
	34
<hr/>	
<i>Answer.</i>	31

Quest. 3. What Number is that which being added to 248 makes the Sum to be 309?

	309
	248
<hr/>	
<i>Answer.</i>	61

Quest. 4. A certain Person born in the Year 1660, how old is he?

	1741
	1660
<hr/>	
<i>Answer.</i>	81

Quest. 5. A Monument built in the Year 1462, how long is that since, reckoning to this present Year 1741?

	1741
	1462
<hr/>	
<i>Answer.</i>	279

Quest.

Quest. 6. The greatest of two Numbers 2400, their Difference is 1472, what is the lesser Number?

$$\begin{array}{r} 2400 \\ 1472 \\ \hline \text{Answer. } 928 \end{array}$$

The third great Rule in *Arithmetick* is *Multiplication*, which is the Art of multiplying one Number by another, to find out the Product.—*MULTIPLICATION* consists in finding some third Number out of two others given; wherein one of the given Numbers is contained, as often as Units is contained in the other. Or *Multiplication* is the finding what will be the Sum of any Number added to itself, or repeated as often as there are Units in another.—So that *Multiplication* of Numbers is a compendious Kind of *Addition*. Thus the *Multiplication* of 4 by 5, makes 20, *i. e.* four Times five amounts to twenty.

The first Things to be considered in *Multiplication* are the *Multiplicand*, the *Multiplier*, and the *Product*.

The *Multiplicand* is the Number given to be multiplied; and is usually, for Method-Sake, the greatest of the two given Numbers.

The *Multiplier* is that by which the *Multiplicand* is multiplied, and is usually the least Number.

The *Product* is the Number arising by the *Multiplication*, and it contains the *Multiplicand* as often as the *Multiplier* contains Units.

The *Multiplicand*, or the Number to be multiplied, is to be placed over that whereby it is to be multiplied; and the *Factum* or *Product* under both. An Example or two will make the Process of *Multiplication* easy. Suppose I would know the Sum 269 multiplied by 8, or 8 Times 269.

$$\begin{array}{r} \text{Multiplicand} \quad 269 \\ \text{Multiplier} \quad 8 \\ \hline \text{Product} \quad 2152 \end{array}$$

The Factors, *i. e.* the *Multiplicand* and *Multiplier* being thus disposed, and a Line drawn underneath, as in the Example, I begin with the *Multiplier* thus, 8 Times 9 makes 72, set down 2, and carry 7 Tens, as in *Addition*; then 8 Times 6 makes 48, and 7 I carried, 55; set down 5, and carry 5; *lastly*, 8 Times 2 makes 16, and with 5 I carried, 21, which I put down: So as coming to number the several Figures placed in Order, 2, 1, 5, 2, I find the *Product* to be 2152.

Now, supposing the *Factors* expressing Things of different Species, *viz.* the *Multiplicand*, *Men* or *Yards*, and the *Multiplier* *Pounds*; the *Product* will be of the same Species with the *Multiplier*; thus the *Product* of 269 *Men*, or *Yards*, multiplied by 8 *Pounds* or *Pence*, is 2152 *Pounds* or *Pence*; so many of these going to the 269, at the Rate of 8 a-Piece.

If the *Multiplier* consists of more than one Figure, the whole *Multiplicand* is to be added to itself, first, as often as the Right Hand Figure of the *Multiplier* shews, then as often as the next Figure of the *Multiplier* shews, and so on. For Example let it be required to multiply 3084 by 36, the Work will stand thus:

$$\begin{array}{r} 3084 \\ 36 \\ \hline 18504 \\ 9252 \\ \hline 111024 \end{array}$$

For 6 Times 4 is 24, I write 4 under the Line, and reserve 2 in Mind for the two Tens; then I say

6 Times 8 is 48, unto which if I add 2 kept in Mind, the whole is 50, wherefore saying, 6 Times 0 is nothing, but the 5 I carried in Mind is 5, which is likewise set under the Line in the next Rank; again 6 Times 3 is 18, which I write wholly down, so that the particular *Product* arising from the multiplying Figure 6, is 18504. In like Manner proceeding with the multiplying Figure 3, the particular *Product* arising will be 9252. *Lastly*, These several *Products* being placed in due Order, and added together, will give 111024, which is the total *Product* arising from the *Multiplication* of 3084 by 36, as it appears by the Operation here above.

The *Product* arising from each Figure of the *Multiplier*, multiplied into the whole *Multiplicand*, is to be placed by itself in such a Manner, that the first or Right Hand Figure thereof may stand under that Figure of the *Multiplier*, from which the said *Product* arises. This Disposition of the Right Hand Figure of each *Product*, being always of the same Denomination with that Figure of the *Multiplier*, from which it arises, for Example.

$$\begin{array}{r} \text{Multiplicand} \quad 421 \\ \text{Multiplier} \quad 23 \\ \hline \text{Particular Product of } 421 \times 3 \quad 1263 \\ \text{Particular Product of } 421 \times 2 \quad 842 \\ \hline \text{The total Product} \quad 9683 \end{array}$$

Thus the Figure 2 in the *Product* 842 is of the Denomination of Tens, as well as the Figure 2 in the *Multiplier*; for 1×20 (that is the 2 of 23) = 20, or 2 put in the Place of Tens, or second Place. Hence if either of the Factors have one or more Cyphers on the Right Hand, the *Multiplication* may be performed without regarding the Cyphers, 'till the *Product* of the other Figures be found; to which they are to be then affixed on the Right: And if the *Multipliers* have Cyphers intermixed, they need not to be regarded at all. Instances of each follow:

$$\begin{array}{r} 12 \quad 358 \\ 010 \quad 6000 \\ \hline 120 \quad 2148000 \\ \hline \end{array}$$

$$\begin{array}{r} 10 \quad 2400 \\ 10 \quad 30 \\ \hline 100 \quad 72000 \\ \hline \end{array}$$

$$\begin{array}{r} 8013 \\ 5006 \\ \hline 48078 \\ 4006500 \\ \hline 40113078 \end{array}$$

Thus much of *Multiplication*, where the *Multiplier* consists wholly of *Integers*, in the Practice whereof it is supposed, the Learner is apprized of the *Product* of any of the nine Digits multiplied by one another, easily learnt from the common Table, called *Pythagoras* or *Multiplication Table*, which is a Square formed of a hundred lesser Squares or Cells, containing the *Product* of several Digits or simple Numbers, multiplied by each other.

As it is absolutely necessary, that those who learn *Arithmetick*, should have the several *Multiplications*, contained in this Table, by Heart, we have thought fit to subjoin it here; with an Example to shew the Manner of using it.

PYTHAGORAS, or *Multiplication Table*.

1	2	3	4	5	6	7	8	9	10
2	4	6	8	10	12	14	16	18	20
3	6	9	12	15	18	21	24	27	30
4	8	12	16	20	24	28	32	36	40
5	10	15	20	25	30	35	40	45	50
6	12	18	24	30	36	42	48	54	60
7	14	21	28	35	42	49	56	63	70
8	16	24	32	40	48	56	64	72	80
9	18	27	36	45	54	63	72	81	90
10	20	30	40	50	60	70	80	90	100

EXAMPLE.

Suppose it were required to know the Product of 6 multiplied by 8, look for 6 in the first horizontal Column, beginning with one; then look for 8 in the first perpendicular Column, beginning likewise with 1; the Square or Cell, wherein the perpendicular Column from 6 meets with the horizontal one from 8, contains the Product required, viz. 48. Suppose likewise it were required the Product of 5 multiplied by 7, look for 5 in the first horizontal Column, beginning with 1, then look for 7 in the first perpendicular Column, beginning likewise with 1; the Square wherein the perpendicular Column from 7, meets with the horizontal one from 5 contains the Product required, viz. 35.

There are also some Abbreviations in this Art.---- Thus, to multiply a Number by 5, you need only add a Cypher to it, and then halve it.—To multiply by 15 do the same, then add both together the Sum is the Product.

Where the *Multiplicator* is not composed wholly of *Integers*; as it frequently happens in Business, where Pounds are accompanied with Shillings and Pence; Yards with Feet and Inches; the Method of Procedure, if you multiply by a single Digit, is the same as in simple Numbers, only carrying from one Denomination to another, as the Nature of each Species requires. For Example, To multiply 123 l. 14 s. 9 d. 3 q. by 5, say $5 \times 3 q. = 15 q.$, that is 3 d 3 q. write down the 3 q. and proceed, saying, $5 \times 9 d. = 45 d.$ That is 3 s. 9 d. set down the 9 d. and proceed in the same Manner through the rest.

If you multiply by two or more Digits, the Methods of Procedure are as follow. Suppose I have bought 37 Ells of Cloth at 13 l. 16 s. 6 d. per Ell, and would know the Amount of the whole. I first multiply 37 Ells by the 13 l. in the common Method of *Multiplication* by *Integers*, leaving the two Products without adding them up; then multiply the same 37 Ells by 16 Shillings, leaving, in like Manner the two Products without adding them. *Lastly*, I multiply the same 37 by the 6 d. the Product whereof 222 d. which divided by 12 gives 18 s. 6 d. and this added to the Product of the 16 s. the Sum will be 610 s. 6 d. the Amount of 37 Ells, at 16 s. and 6 d. the Ell. *Lastly*, the 610 s. 6 d. are reduced into Pounds, by dividing them by 20; upon adding the whole, the Amount of 37 Ells at 13 l. 16 s. 6 d. will be found as in the following.

37 Ells at 13 l.	37 Ells at 16 s.	37 Ells at 6 d.
111	222	222
37	37	
50 10 6	18 6	
Prod. 511 10 6	610 6	

Or thus: Suppose the same Question; reduce the 13 l. 16 s. into Shillings, the Amount will be 276 s. reduce 276 s. into Pence, adding 6. the Amount will be 3318 d. multiply the 37 Ells by 3318 d. the Amount will be 122766 d. which divided by 12, and the Quotient 10230 s. 6 d. reduced into Pounds by cutting off the last Figure on the Right, and taking Half of those on the Left, yields 511 l. 10 s. 6 d. the Price of the 37 Ells, as before.

The Proof of *Multiplication*, as is commonly used, is by casting away the 9's out of the *Multiplicand*, *Multiplicator*, and *Product*; but this Proof being very erroneous, as is evident to all such as know the Rule, I shall therefore, forbear shewing that Method, by Reason the true Proof of *Multiplication*, is by *Division*, and *Division* by *Multiplication*; for as *Multiplication* increaseth, so *Division* decreases; as it will appear by the following Definition of *Division*.

DIVISION, which is the last of the four great Rules in *Arithmetick*, is that whereby we find how often a less Quantity is contained in a greater; and the Overplus; *Division* being nothing else, in Reality, but a compendious Method of *Subtraction*; its Effect being to take a less Number from another greater, as often as possible; that is, as oft as it is contained therein. There are therefore three Numbers concerned in *Division*, viz. 1. The *Dividend*. 2. The *Divisor*. 3. The *Quotient*.

The *Dividend*, is the Number given to be divided into equal Parts. The *Divisor* is the Number, by which the *Dividend* is to be divided; that is, it is the Number that shews into how many equal Parts the *Dividend* must be divided. The *Quotient* is the Number which discovers how often the *Divisor* is contained in the *Dividend*, which is the Number produced by the *Division*; so, if 40 were given to be divided by 8, the Number produced would be 5.

$$\begin{array}{r} \text{Dividend} \\ \text{Divisor } 8) 40 \text{ (5 Quotient)} \\ \underline{40} \\ 0 \end{array}$$

This Method must be observed in every *Division*; *First*, To ask how many. *Secondly*, Multiply. *Thirdly*, Subtract. For Example: Let it be required to divide 88 by 4, first write down the *Dividend*, and then draw a Parenthesis, and place the *Divisor* on the left Hand thereof, then draw a Line under the *Dividend* Thus,

$$\begin{array}{r} \text{Dividend} \\ \text{Divisor } 4) 88 \text{ (22 Quotient)} \\ \underline{8} \\ 8 \\ \underline{8} \\ 0 \end{array}$$

Thus having placed a *Parenthesis* at each End of the *Dividend*, that on the left Hand for the *Divisor*, and that on the right for the *Quotient*; then if the *Divisor* be a single Figure, subscribe a Point under the first Figure of the *Dividend* towards the left Hand, and ask how often the *Divisor* 4 is contained in the *Dividend* 8; the Answer is 2, wherefore I write 2 in the *Quotient*; then multiplying the *Divisor* 4 by 2, (the Number placed in the *Quotient*) the Product is 8, which I place orderly under the *Dividend* 8; and after a Line is drawn underneath the Product, I subtract it from the *Dividend* 8, and place the Remainder underneath the Line. Then proceed and place another Point under the next Place of the *Dividend*, towards the Right Hand, and bring down the Figure or Cypher standing in that Place to the Remainder; that is, set it next after it, so the whole will be a new *Dividend*: Thus a Point being placed under the other 8,

I write

I write down 8 next after 0, to wit, on the Right Hand of the Remainder 0; so is 8 a new Dividual or Number, whereof the second Question must be asked, and the Work will stand thus:

$$\begin{array}{r} 4) 88(22 \\ 8. \\ \hline 08 \\ 8 \\ \hline 0 \\ \hline \end{array}$$

A new Dividual being brought down, which is 8, renew the Question, and ask how often 4 is contain'd in 8; the Answer is 2, wherefore I write 2 in the Quotient; then multiplying the Divisor 4 by 2, the Product is 8, which I place under the Dividual 8, and after a Line is drawn, I subtract the Product 8, from the Dividual 8, and there being no Remainder, I place 0 under the Line: So the whole Work is finished, the Quotient is found 22. Wherefore I say that if 88 Pounds were to be divided among four Persons, the Share of each will be 22 Pounds.

The Operation is a great deal more difficult, when the Divisor consists of two, three, or several Figures; though it depends on the same Rules; for Example.— Let it be required to divide 896487 by 648, or, which is all one, to divide 896487 into 648 equal Parts.

First a Table must be made, to shew, at first Sight, any Product of the Divisor, it being taken twice, thrice, or any Number of Times under ten, so having written down the Divisor itself 648, and drawn a Line on the Right-hand thereof, I place 1 on the Right-hand of the Line directly against the Divisor; then underneath the Divisor 648, I place the double thereof which is 1296, and place the Figure 2 directly against the said double on the other side of the Line; again by multiplying the Divisor 648 by 3, the Sum is 1944, this triple I place under the double, and place 3 on the other Side of the Line right against the triple; and so proceeding, in like manner, with the quadruple, quintuple, sextuple, &c, to the nonuple of the Divisor:

Divisor 648	1
1296	2
1944	3
2592	4
3240	5
3888	6
4536	7
5184	8
5832	9

Now for a Proof of the said Table, adding the last Number thereof, to wit 5832, which 648 was found to be nine times the Divisor, to the Divisor 648, I find the Sum to be 6480, which is ten times the Divisor, as you may see in the Margent; wherefore I conclude the Table is true, because the last Number thereof is derived from all the superior Numbers.

The principal Method of Division (which to those who have the Multiplication Table by Heart, is easy enough) is when the Divisor consists of more Places than one, to set out so many Figures on the Left-hand of the Dividend for a Dividual, and then put a Point under the Figure of the Dividual, which stands next to the Right-hand. Then seek how often the first Figure towards the Left-hand of the Divisor, is contained in the first Figure towards the Left-hand of the said Dividual, and place the Answer in the Quotient. Then multiply the whole Divisor by the said Figure so placed in the Quotient, and place the Product in order under the Dividend. Which being done, subtract the said Product from the Dividual, placing the Remainder under the Line. Then put a Point under the next Figure of the Dividend,

and annex it to the Remainder, so you have a new Dividual, in which you are to proceed as shall be directed. For Example.

Let it be required to divide 8904 by 42, here the given Number being disposed of, as before directed, will stand thus;

$$42) 8904($$

Then because there are two Figures in the Divisor, therefore you must take the two first Figures on the Left hand of the Dividend for a Dividual, which is 89, putting a Point under the 9. Then I ask how often the first Figure 4 is contained in the first Figure 8, the Answer is two times, wherefore I multiply 2 in the Quotient by 42, the Divisor and the Product is 84, which I place directly under 89, and subtract it, and there will remain 5. Then I put a Point under the next Figure, which is 0, and annex it to the Remainder 5, and it makes 50 for a new Dividual, and the Operation will stand as follows;

$$\begin{array}{r} 42) 8904(21 \\ 84. \\ \hline 50 \\ \hline \end{array}$$

Asking afterwards how often I can have 4 in 5, the Answer will be 1, which I place in the Quotient, and multiply the Divisor 42 by 1 which makes 42, which I place under 50, and subtract it from 50, and there will remain 8, which I place in order under the Line, and thereto annex the next Figure of the Dividend which is 4, and then it makes 84 for a new Dividual, and then the Operation will stand as follows;

$$\begin{array}{r} 42) 8904(212 \\ 84. \\ \hline 50 \\ 42 \\ \hline 84 \\ 84 \\ \hline 0 \\ \hline \end{array}$$

For a Conclusion, I ask how often 4 is contained in 8, and the Answer will be 2 times, wherefore I put 2 in the Quotient, and thereby multiply the Divisor 42 by 2, which makes 84, and by subtracting 84 from 84 the Remainder is nothing, and the Operation is ended; so that if I divide 8904 Pounds amongst 42 Persons, each Person must have 212 Pounds.

Whenever the Product of the Multiplication by the Divisor is greater than the Dividual from which it ought to be subtracted, such Product must be struck out; and a lesser Figure is to be placed in the Quotient, for you cannot subtract a greater Figure from a lesser. For Example, if it be required to divide 4763585 by 587, because the Divisor 587, is bigger than the Dividual 476, I therefore put my Point to 3, then the Dividual becomes 4763, from which taking the Divisor 587 out of the Dividual, I find it 8 times (for 9 times is too much) so placing 8 in the Quotient, and having multiplied the Divisor thereby, which is 4696, and subtracting it out of 4763, the Remainder is 67, to which, by putting a Point to 5, then I have 675 for a new Dividual, and so proceeding according as before taught, your Quotient will be 8115, and 80 for the Remainder.

Thus 587)4763585(8115

4696...

$$\begin{array}{r} 675 \\ 587 \\ \hline 888 \\ 587 \\ \hline 3015 \\ 2935 \\ \hline \end{array}$$

80 the Remainder.

There is another Method of *Division*, preferable to any common Way of dividing, by dashing out of Figures, where the Steps of the *Division* are so confounded, by a promiscuous *Multiplication* and *Division*, that if any Error happens, it can scarce be corrected without beginning the Work a-new; but in this, explained underneath, the particular *Multiplications*, *Subtractions* and *Remainders*, which belong to every Figure of the *Quotient*, are so distinctly and clearly set down, that if an Error happen it may easily be reformed. As for Example.

Let it be required to divide 7910010295 by 59746; the Operation will stand thus:

59746)7910010295(132393

59746.....

$$\begin{array}{r} 193541 \\ 179238 \\ \hline \end{array}$$

$$\begin{array}{r} 143030 \\ 119492 \\ \hline \end{array}$$

$$\begin{array}{r} 235382 \\ 179238 \\ \hline \end{array}$$

$$\begin{array}{r} 561449 \\ 537714 \\ \hline \end{array}$$

$$\begin{array}{r} 237355 \\ 179238 \\ \hline \end{array}$$

58117 Remainder.

132393 Quotient mult. by
59746 Divisor

794358

529572

926751

119157

661965

7909952178

58117 Remainder added

7910010295 Proof

We must observe that there are to be as many Points in the *Dividend*, as there are Figures in the *Quotient*, as in this Example, you have six Points in the *Dividend* and six Figures in the *Quotient*.

Division is proved by multiplying the *Quotient* by the *Divisor*, or the *Divisor* by the *Quotient*, and adding what remains of the *Division*, if there be any thing. If the Sum be found equal to the *Dividend*, the Operation is just, otherwise there is a Mistake.

These four great Rules, viz. *Addition*, *Subtraction*, *Multiplication* and *Division*, are the Foundation of all those other Operations in *Arithmetick*, I am going to demonstrate and elucidate, beginning by *Reduction*, which is the converting of Money, Weights, or Measures, into the same Value in other Denominations; for Instance, Pounds into Shillings and Pence; and Shillings and Pence into Pounds.

REDUCTION is of two Kinds: 1st, *Descending*, when a Quantity is to be brought from a higher Denomination to a lower. This is done by considering how many of the less next Denomination are contained in the next greater before, and by that Number multiplying the greater. Thus Pounds are reduced into Shillings by multiplying by 20; Shillings into Pence by multiplying by 12, and Pence into Farthings by multiplying by 4.

2^d, *Ascending*, when a lower Denomination is to be reduced to an higher. This is done by Division. These two Kinds of *Reduction* will be confirmed by the following Examples.

Example of the Descending Reduction.

If I am asked how many Farthings there are in 564 Pounds, I must first multiply the 564 by 20, the Product whereof will be 11280 Shillings; then proceed to multiply the Shillings by 12, for the Reduction of them into Pence, and the Product will be 135360 Pence, which being multiplied by 4, will produce 541440 Farthings.

$$\begin{array}{r} 564 \\ 20 \\ \hline 11280 \text{ Shillings} \\ 12 \\ \hline 22560 \\ 11280 \\ \hline 135360 \text{ Pence} \\ 4 \\ \hline 541440 \text{ Farthings} \end{array}$$

Example of the Ascending Reduction.

In order to perfect this Operation, you must divide the least by so many of its Denomination as are contained in the next greater; Thus 24720 Pence divided by 12, and the Quotient by 20, give 103 *l*. If there remains any thing in each Division, it is respectively either odd Pence, or Shillings: Thus 6713 reduced, give 27 *l*. 19 *s*. 5 *d*. Cut off the Last, the rest are the Pounds required.

If I be asked in 541440 Farthings how many Pounds (which is the Reverse of the Example for the *Descending Reduction*) the Operation will stand thus.

$$\begin{array}{r} 12) \quad 20) \\ 4)541440(135360(11280 \\ 4 \dots 12 \dots \hline 564 \text{ Pounds answer'd} \\ \hline 14 \quad 15 \\ 12 \quad 12 \\ \hline 21 \quad 33 \\ 20 \quad 24 \\ \hline 14 \quad 96 \\ 12 \quad 96 \\ \hline 24 \quad 00 \\ 24 \quad \hline 00 \end{array}$$

To expedite the Practice, several compendious Ways of *Reduction* have been invented. Thus Yards are turned into Ells, by subtracting a Fifth, and into Ells *Flemish* by adding a Fifth. Ells *Flemish* are reduced into Yards by subtracting a Quarter. Ells *Flemish* reduced to Ells *English* by multiplying by 6, and cutting off the right-hand Figure. Great Pounds of Silk of 24 Ounces, are reduced to Pounds of 16 Ounces, by adding one Half. Pounds of 16 Ounces into Pounds of 24, by subtracting one Third.

Tare and Tret is also another Kind of Reduction.

Tare is an Abatement or Deduction on the Price of a Commodity, on account of the Weight of Casks, Casks, Bags, Frails, &c. The Cask, Chest, or whatever else contains the Commodity, is also called *Gross*.

Tret is an Allowance made, in Commerce, for the Waste, or the Dust, that may be mixed with any Commodity; which is always 4 Pounds in every 104 Pounds.

The *Tare* is very different in different Merchandizes: In some there is none at all allowed. It is a Thing much more regarded in *Holland* than in *England*, or elsewhere. M. Ricard treating of the Commerce

merce of *Amsterdam*, observes, that the *Tares* are one of the most considerable Articles a Merchant is to be acquainted withal, if he would trade with Security.

Sometimes the *Tare* is, as it were, regulated by Custom; but generally, to avoid all Dispute, the Buyer and Seller make a particular Agreement about it. We shall here add from the forementioned Author, some Instances of *Tare* allowed at *Amsterdam*.

Spanish Wool is subject to a Kind of double *Tare*; for first they deduct the *Tare* marked on the Bales, and after that 24 Pounds *Tare* for every 175 Pounds Weight, besides the Rebate for prompt Payment. Indeed for the common Wools, the Seller will seldom allow above 14 per Cent. for the whole *Tare*; for which Reason the Bargain is to be agreed on before.

Tare of { Roman Allum is 4 lb. per Sack.
Irish, &c. Butter, 20 per Cent.
Crude Borax, 15 lb. per Cent.
Cinnamon, 17 lb. the Burthen.
Capers 33 lb. per Cent.
White Pepper, 40 lb. per Barrel.
Black Pepper, 5 lb. &c.

But to reduce *Tare* and *Tret* into Practice with regard to Arithmetick; if I be asked, for Example, in 48 C. 3 qrs. 14 lb. *Tare* 3 C. 3 qrs. 17 lb. how many Pounds neat; I proceed thus:

C.	qrs.	lb.	
48	3	14	Gross
3	3	00	Tare deducted
<hr/>			
45	0	14	
4			
<hr/>			
180			Quarters
28			
<hr/>			
1444			
361			
<hr/>			
5054			Pounds neat

C.	qrs.	lb.	
112)	5054	(45 0 14 neat	
	448		
<hr/>			
	574		
	560		
<hr/>			
	14		

Which Pounds neat being divided by 112, gives me 45 C. 0 qrs. 14 lb. neat Weight.

Or this other Question: In 145 C. 2 qrs. 16 lb. *Tare* 14 per Hundred, *Tret* 4 per 104, how many Pounds neat: To answer which I proceed in the following Manner:

C.	qrs.	lb.		C.	qrs.	lb.	
145	2	16		145	2	16	
4				14			
<hr/>				<hr/>			
582			Quarters	580			
28				145			
<hr/>				<hr/>			
4662				2030			
1165				9			allowed for the 2 qrs.
<hr/>				<hr/>			16 lb.
16312			lb. Subtle	2039			
2039			lb. Tare	<hr/>			
<hr/>				<hr/>			
14273			Remainder	26)	16312	(627 lb. Tret	
627			lb. Tret		156		
<hr/>				<hr/>			
13646			lb. neat				

I divide the Pounds, by Subtle, by 26, because 4 Pounds is the 26th of 104 the Allowance always given for *Tret*.

71
52
192
182
10

C. qrs. lb.
112)13646(121 3 10
112

Or the Pounds neat being divided by 112, makes 121 C. 3 qrs. 10 lb. neat Weight.

And thus of all other Commodities, or Merchandizes, in Proportion.

The RULE OF THREE DIRECT, (also called, the *Golden Rule*, and the *Rule of Proportion*) is the next which falls under our Consideration.

The *Rule of Three* teaches how to find a fourth proportional Number, to three others given.

In this Rule we must always observe, in stating the Question, to make our first and third Number be of one Denomination, and the second Figure being the Supposition, must, after the Operation, be found in the same Degree, with the fourth Number sought. We must also make our first and third Numbers both of one kind. Then go unto the second or middle Number, and reduce that into the lowest Value there named; then multiply our second Number under our third, making that Number our *Dividend*, and divide by our first Number, and the *Quotient* of our *Division* answers the Question demanded; and is always of the same Denomination with our second Number, whether Pounds, Shillings, Pence, or Farthings, or any other Name or Kind whatever; which if it shall happen to be of any greater Number, whether of Weight, Measure, or Time, we may reduce them into its lowest Value, by the Rule of *Reduction* before taught.

Quest. If three Degrees of the Equator contain 70 Leagues, how many do 360 Degrees, the Circumference of the Earth, contain?

The Rule is this: Multiply the second Term 70, by the third 360, divide the *Product* 25200 by the first Term 3, the *Quotient* 8400 is the fourth Term required.

The Use of this *Rule* is of vast Extent both in common Life, and the Sciences; but has no Place but where the Proportion of the given Numbers is known. Suppose, for Instance, a large Vessel full of Water to empty it self by a little Apperture; and suppose three Gallons to flow out in a Minute; and it were required to know in what Time 100 Gallons would be thus evacuated: Here indeed are three Terms given and a fourth required, but as it is evident from Experience, that Water flows faster at first than afterwards, the Quantity of flowing Water is not proportional to the Time; and therefore the Question does not come under the *Rule of Three*.

The Things which come under Commerce are proportionable to their Prices; twice as much of any Commodity costing twice as much Money, &c. The Price therefore, of any Quantity of a Commodity being given, the Price of any other Quantity of the same, or Quantity of the Commodity answering to any other given him, is found by the *Rule of Three*. For Example, If 3 lb. cost 17 s. what will 30 lb. cost? Since as 3 lb. are to 30 lb. so is the Value of the former 17 s. to the Value of the Latter. The Question stands thus:

lb.	s.	lb.
3	17	30
<hr/>		17
		210
		30
<hr/>		
8 l. 10 s.		3) 510 (170 s.

Again,

Again, if 3 Pounds be bought for 17 s. how many will 170 s. buy; since as 17 s. is to 170 s. so are 3 Pounds to the Pounds required: The Number will be found thus:

$$\begin{array}{r}
 \text{s.} \qquad \text{lb.} \qquad \text{s.} \\
 17 \text{ --- } 3 \text{ --- } 170 \\
 \qquad \qquad \qquad 3 \\
 \hline
 17) 510 (30 \text{ lb.} \\
 \underline{51} \\
 00 \\
 \hline
 \end{array}$$

If the given Terms be heterogeneous, *i. e.* have broken Numbers among them, they do not bear the same Proportion to each other with the Things they express bear. They must therefore be reduced to homogeneous ones, or to the same Denomination, as Pounds into Shillings, &c. as I have observed already. For Example; If 3 lb. and 4 oz. cost 2 s. 4 d. what will 2 lb. cost. The Operation will run thus:

$$\begin{array}{r}
 \text{lb. Oz.} \qquad \text{s. d.} \qquad \text{lb.} \\
 3 \text{ 4 --- } 2 \text{ 4 --- } 2 \\
 16 \qquad \qquad 12 \qquad \qquad 16 \\
 \hline
 53 \qquad \qquad 28 \qquad \qquad 32 \\
 \qquad \qquad \qquad \qquad \qquad 28 \\
 \hline
 \qquad \qquad \qquad \qquad \qquad 256 \\
 \qquad \qquad \qquad \qquad \qquad 64 \\
 \hline
 52) 896 (17 \text{ d. } \frac{1}{2} \\
 \underline{52} \\
 376 \\
 \underline{364} \\
 12 \\
 \hline
 \end{array}$$

In many Cases of Commerce and Account, we have more compendious Ways of working Questions that come under the *Rule of Three*, than by the *Rule* itself, which by Reason of their expediting Practice, are called *PRACTICE*, and constitute a particular Rule of themselves; especially where the first Term is 1, or Unity. These Practices are called *Italian Practices* or *Usages*, because first introduced by the Merchants, and Negotiants of *Italy*. The most useful of these Practices are as follow.

1. Since the Use of the *Rule of Three*, is to find a fourth Proportional to three given Numbers, divide the first and second, or the first and third, by some common Number, if that can be done exactly; and work with the *Quotient* in their Stead; as in the following Example.

$$\begin{array}{r}
 \text{Price of 3 lb. is 9 s. what is the Price of 7 lb?} \\
 3) 1 \qquad 3 \qquad \qquad 3 \\
 \hline
 \text{Fecit 21 s.}
 \end{array}$$

$$\begin{array}{r}
 \text{Price of 14 lb. is 26 s. what is the Price of 7 lb?} \\
 7) 2 \qquad 2) \text{ --- } \qquad \qquad 1 \\
 \hline
 \text{Fecit 13 s.}
 \end{array}$$

2. If the first Term be 1, and the second an aliquot Part of a Pound, Shilling, or Penny; divide the third by the aliquot Part; the *Quotient* is the Answer. *Note*, that the *aliquot* Part is such Part of any Number or Quantity, as will exactly measure it, without any Remainder. Or it is a Part, which being taken a certain Number of Times, becomes equal to the whole or Integer. Thus 3 is an aliquot Part of 12, because being taken four Times, it will just measure it.

For Example, if 1 Ell cost 10 s. what cost 957 Ells?

$$\text{Fecit 478 l. 10 s.}$$

3. If the first or third Number be 1, the other not exceeding large, and the Middle Term a Compound, *i. e.* consists of several Denominations; it may be wrought without *Reduction* thus:

Price of 1 lb. is 3 s. 8 d. $\frac{3}{4}$, what is the Price of 5 lb?

$$\begin{array}{r}
 \text{s. d.} \\
 3 \text{ 8 } \frac{3}{4} \\
 \hline
 5 \\
 \hline
 \text{Fecit 18 7 } \frac{3}{4}
 \end{array}$$

For four Farthings making a Penny, 5 Times 3 Farthings make 3 d. $\frac{3}{4}$ and 12 Pence making One Shilling, 5 Times 8 Pence make 3 s. 4 d. which with 3 d. from the Place of Farthings, make 3 s. 7 d. *Lastly*, five Times 3 s. make 15 s. and with the 3 s. from the Place of Pence 18 s. the Price required therefore is 18 s. 7 d. $\frac{3}{4}$.

4. If the middle Term be not an Aliquot, but an aliquant Part, resolve the aliquant Part into its aliquot Parts; divide the middle Term by the several Aliquots, the Sum of the *Quotient* is the Answer. *Note*, Aliquant Part is that which will not measure or divide any Number exactly, but some Remainder will still be left. Or, an aliquant Part, is that which being taken any Number of Times, is always greater or lesser than the whole. Thus 5 is an aliquant Part of 12; for being taken twice it falls short; and when taken three Times it exceeds 12.

For an Instance of this Rule:

$$\begin{array}{r}
 \text{If 1 Ell costs 15 s. What costs 124 Ells?} \\
 \frac{1}{2} \qquad \qquad \frac{1}{2}) 62 \\
 \frac{1}{4} \qquad \qquad \qquad 31 \\
 \hline
 \text{Fecit 93 l.}
 \end{array}$$

5. If the first or second Term be 1; and in the former Case the second or third; in the latter the first, be resolvable into Factors; the Operation may be performed in the Mind without writing down any Figures; as in the following Example:

$$\begin{array}{r}
 \text{Price of 1 lb. is 24 s. What is 20 lb.} \\
 4 \qquad \qquad \qquad 4 \\
 6 \qquad \qquad \qquad 80 \\
 \hline
 6 \\
 \hline
 \text{Fecit 480 s. 24 l.}
 \end{array}$$

6. Where one of the given Numbers is 1, we have several compendious Usages to save *Multiplication* and *Division*, *e. gr.*

If 9 lb. costs 20 s. What does 1 lb.

It is obvious the Sum required is had by adding to the tenth Part of 20 Shillings, *viz.* 2 s. the ninth Part of that Tenth, *viz.* 3 d. $\frac{1}{2}$ and $\frac{2}{5}$ of a Penny; the Answer therefore is 2 s. 3 d. $\frac{1}{2}$ and $\frac{2}{5}$.

Again if 5 l. costs 45 s. what costs 1 lb.

Since 5 is half of 10, the Double of the tenth Part of the given Price, *viz.* 10 s. 9 d. $\frac{1}{4}$, 9 is the Sum required.

Again if 1 l. costs 18 d. What will 19 lb. cost?

Since 19 = 20 - 1; from the given Price doubled and increased by a Cypher, *viz.* 360, subtract the simple 18, the Remainder is 342 d. = 28 s. 6 d. the Sum required.

7. If two Terms of the same Denomination differ by an Unit, we have a peculiar Kind of Compound, which will be clear from the following Examples, *e.g.*

If 5 *lb.* costs 30 *s.* What will 4 *lb.* cost?

Since the Price of 4 *lb.* is one fifth Part short of that of 5 *lb.* divide the given Price 30 by 5; the Quotient 6 being subtracted from the Dividend, the Remainder, *viz.* 24 *s.* is the Sum required.

Again, if 8 *lb.* costs 24 *s.* What costs 9 *lb.*?

Since the Price of 9 *lb.* exceeds that of 8 by one eighth Part; divide the given Price 24 by 8, and add the Quotient 3 to the Dividend; the Sum 27 is the Answer.

8. Sometimes one may use several of these Compounds or Practices in the same Question. *e.g.*

If 100 *lb.* costs 30 *s.* 4 *d.* What costs 50 *lb.*?

50)2.2. Fecit 15 *s.* 2 *d.*

Again 60 *lb.* costs 4 *s.* What costs 2520 *lb.*?

6	42
---	---
24	6
7	7
---	---
168 <i>l.</i>	

The RULE OF THREE INVERSE, is where the natural Order of the Terms is inverted. As if 100 Workmen build a House in 2 Years, in how long a Time will 200 Workmen build the same?

This is usually considered by the Writers of *Arithmetick*, and taught in the Schools as a particular Rule; being wrought by multiplying the first Term 100 by the second 2, and dividing the Product 200 by the third Term 200, the Quotient 1 is the Number required.

But there is no Necessity for making a particular Rule for the Matter; this coming naturally enough under the former, by only ranging the Terms as the Nature of the Question requires. Thus it is evident, that as the Number of Men 200 is to 100, so is the Space 2 Years, wherein 100 build the House, to the Space wherein 200 will build the same. For the less Time the more Hands are required; the Question then will stand thus:

$$\begin{array}{r} 100 \text{ M.} \text{ --- } 2 \text{ Y.} \text{ --- } 200 \text{ M.} \\ 2 \\ \hline 200)200(1 \text{ Year.} \end{array}$$

COMPOUND RULE OF THREE, or Rule of five Numbers, is where two Rules of Three are required to be wrought, before the Number sought be found. As if 300 *l.* in 2 Years yield 30 *l.* Interest, how much will 1000 *l.* yield in 12 Years?

Here the first Thing to be done is to find by the Rule of Three, what Interest 1000 *l.* will give in 2 Years; and then by the same Rule what it will give in 12 Years?

This is considered by the Writers, &c. of *Arithmetick*, as a particular Rule, but without any Necessity; a double Operation solving it better, as in this Example:

$$\begin{array}{r} 300 \text{ l.} \text{ --- } 1000 \text{ l.} \text{ --- } 30 \text{ int.} \\ 30 \\ \hline 3)300)300|00(100 \text{ int.} \end{array}$$

$$\begin{array}{r} 2 \text{ Y.} \text{ --- } 12 \text{ --- } 100 \text{ l.} \\ 12 \\ \hline 2)12000(600 \text{ int.} \end{array}$$

But in Questions of this Kind a single Rule of Three may do the Business: For 300 *l.* give the same Interest in 2 Years, which twice 300 give in one Year; and 12 Times 1000 *l.* give the same Interest in one Year, that 1000 give in 12: Omitting therefore the Circumstances of Time say, if twice 300 (that is 600) give 36 *l.* Interest (in one Year) what will 12 Times 1000 (that is 12000) give (in one Year)?

$$\begin{array}{r} 600 \text{ --- } 12000 \text{ --- } 36 \\ 36 \\ \hline 72000 \\ 36000 \\ \hline 6)100)4320|00(720 \text{ l. int.} \end{array}$$

The next Rule, deserving our Notice, is that of *Fellowship*, which is a Rule of great Use in ballancing Accomps amongst Merchants and Owners of Ships; where a Number of Persons putting together a general Stock, it is required to give every one his proportional Share of his Loss or Gain.

The Rule of Three several Times repeated is the Basis of *Fellowship*, and fully answers all the Questions of that Kind; for as all the whole Stock is to the Total thereby gained or lost; so each Man's particular Share is to its proper Share of Loss or Gain. Wherefore the several Sums of Money of every Partner are to be gathered into one Sum for the first Term; the common Gain or Loss for the second; and every Man's particular Share for the third; and the *Golden Rule* to be wrought so many Times as there are Partners.

There are two Cases in this Rule, the one *without*, the other *with Time*.

FELLOWSHIP WITHOUT TIME, is where the Quantity of Stock, contributed by each Person, is alone considered; without any particular Regard to the Length of Time, that any of their Monies were employed. An Example will make this Process easy.

A. B. and C. freight a Ship with 212 Ton of Wine; A. laying out 1342 *l.* B. 1178 *l.* and C. 630 *l.* towards the same; the whole Cargo is sold at 32 *l.* per Ton; Query, what shall each Person receive?

Find the whole Produce of the Wine by multiplying 212 by 32, which yields 6784. Then adding together the several Stocks, 1342, 1148, and 630; which make 3150, the Work will stand thus:

$$\begin{array}{r} 3150:6784 \left\{ \begin{array}{l} 1342 \text{ --- Answer --- } 2890 \\ 1178 \text{ --- } 2537 \\ 630 \text{ --- } 1356 \\ \hline \text{Proof } 3150 \text{ --- } 6783 \end{array} \right. \end{array}$$

BARTER is next in Order. *Barter* is the exchanging Wares for Wares, or one Commodity for another, for Example:

Two Merchants barter. A. has 3 C. 2 Qrs. of Pepper at 13 *d.* $\frac{1}{2}$ per lb. B. has Ginger at 15 *d.* $\frac{1}{4}$ per lb. I would know how much Ginger must be delivered for the Pepper. The Process is thus:

G g g

1. If

Interest is either *simple* or *Compound*.

Let that which is the principal Cause of the *Interest* be put in the first Place, that which betokeneth Time in the second Place, and the Remaining in the third. Under this conditional Part place the two other Terms, each under its like, and there will be a Blank to supply under one of those above, either under the first, second, or third.

1.	Months	1.
100	12	6
50	03	

If the Demand had been, in how many Months would 50*l.* have gained 15*s.* or if 100*l.* in twelve Months gains 6*l.* what shall the Principal be that in three Months would gain 15*s.* In these Cases the Blank would have been under the first or second Term; then by another Rule, multiply the first, second, and last for a Dividend, and the third and fourth for a Divisor; the Quotient is the Answer.

1. Months 1.
100 12 6
3 75 = 15s.

This *Rule* shews *Simple Interest*, and all that belongs to it, with Ease, and was thus found: Put *P* for the Principal, *T* for the Time, and *G*, for the Gain in the Conditions, and *p t g* answering, it will be, $P : G :: t : p : \frac{GP}{P}$ and $T : Gp :: t : \frac{Gpt}{TP} = g$, which is the first Rule; that is, multiply the three last for a Dividend, and the two first for a Divisor, and because $\frac{Gpt}{TP} = g$, therefore $Gtp = TPg$, and consequently $t = \frac{TPg}{Gp}$ and $p = \frac{TPg}{Gt}$, which is the second Rule.

This Sort of Interest is commonly worked by *Decimal Arithmetick*; but for the better understanding of it I shall state a few Questions, to be performed by *Vulgar Arithmetick*. For Example:

If 300*l.* be put out at 6*l. per Cent. per Ann.* reckoning Interest upon Interest, what Money must I receive then?

$\frac{1}{300}$ at $\frac{1}{6}$ per Cent.

	<i>l.</i>	<i>s.</i>	<i>d.</i>	
18 00	300	00	0	Principal
	18	00	0	Interest
	318	00	0	Increase the first Year.

<i>l.</i>	<i>s.</i>	<i>d.</i>	<i>l.</i>
318	00	0	at 6
		6	

19 | 08 00 0
20

160
12

7/20
4

0/80

<i>l.</i>	<i>s.</i>	<i>d.</i>
318	00	0
19	01	7

337 of 7 Increase the
2d Year.

<i>l.</i>	<i>s.</i>	<i>d.</i>	<i>l.</i>
337	1	7	at 6 per Cent.
		6	

20	22	9	6
	20		

449
12

594
4

3176

<i>l.</i>	<i>s.</i>	<i>d.</i>
337	I	7
20	4	5

357 6 0 $\frac{3}{4}$ Increase Third.

$\begin{array}{cccc} l. & s. & d. & l. \\ 357 & 6 & 0 \frac{3}{4} & \text{at } 6 \text{ per. Cent.} \\ & & 6 & \end{array}$

$$21 \overline{) 43} \quad 16 \quad 4 \frac{1}{2}$$

8 | 76
12

9 | 16
4

066

<i>l.</i>	<i>s.</i>	<i>d.</i>	
357	06	0	$\frac{3}{4}$
21	08	9	

378 14 9 $\frac{3}{4}$ Fourth Year.

This Way of Operation is more compendious than by the *Rule of Three*.

First state your Question as before. If 100 l. gain 6 l. what will 300 l. your Principal? Multiply first your Principal by your Interest; that done, cut off the two first Figures towards your Right Hand of the Pounds with a Line. Then multiply them by 20, 12, and 4, and all above two Figures towards your Right Hand, carry over the Line to the Left, as you see in the above-mentioned Example.

Thus much for *Simple* and *Compound Interest* 'till we come to *Decimal Arithmetick*. At present we'll proceed to the Exchange of Coins from one Country to another, which is done by Means of Bills of *Exchange*, i. e. by giving Money in one City, and receiving a Bill to entitle the Giver to receive the Value in another City; to accomplish which, it is necessary a Merchant should know daily upon the *Exchange*, how the Equality or *Par* of Coins rises or falls; since the Rising, Falling, or Debasing of the Coins is so subject to change, especially in *France* and other Countries. The Questions on this Subject may be worked by the *Rule of Three*. For Example:

A Merchant delivered 530 *l. Sterling* in *London*, at 20 *s. per l.* to receive the same, by a Bill of *Exchange*, at *Amsterdam*, the Exchange at thirty-three Shillings and fourpence *Flemish*, for a Pound *Sterling*, I demand the same in *Flemish* Money. *Note*, That in the Stating of your Question, your first and third Num-
bers

$$\begin{array}{r} \text{lb. Oz.} \\ 8 \text{ of } 7 \\ 7 \\ \hline 56 \end{array}$$

$$\begin{array}{r} \text{lb. Oz.} \\ 2) 15 \text{ of } 8 \frac{1}{2} \\ 8 \\ \hline 120 \\ 7 \frac{1}{2} \\ \hline 127 \frac{1}{2} \end{array}$$

$$\begin{array}{r} \text{lb. Oz.} \\ 13 \text{ of } 10 \\ 10 \\ \hline 130 \end{array}$$

$$\begin{array}{r} 12 \left\{ \begin{array}{l} 8 \\ 10 \\ 15 \\ 18 \end{array} \right. \begin{array}{l} \hline 6 \\ 3 \\ 2 \\ 4 \\ \hline 15 \end{array} \end{array}$$

$$\text{Gall.} \\ \text{If } 15 \text{ --- } 84 \text{ --- } 6$$

Facit $33 + \frac{1}{2}$ of the first Sort.

$$\text{Gall.} \\ \text{If } 15 \text{ --- } 84 \text{ --- } 3$$

Facit $16 + \frac{1}{2}$ of the second Sort.

$$\text{Gall.} \\ \text{If } 15 \text{ give --- } 84 \text{ --- what will } 2$$

Facit $11 + \frac{1}{2}$ of the third Sort.

$$\text{Gall.} \\ \text{If } 15 \text{ give --- } 84 \text{ --- what will } 4$$

Facit $22 + \frac{2}{3}$ of the fourth Sort.

which Quantities added up make 84, viz.

$$\begin{array}{r} \text{add } 33 \\ 16 \\ 11 \\ 22 \\ 2 \\ \hline 84 \end{array} \quad \begin{array}{r} \text{Fractions} \\ 3 \\ 4 \\ 1 \\ 2 \\ \hline 10 \end{array} \quad \begin{array}{l} 5) 10 (2 \text{ for Fractions.} \\ \hline 10 \text{ Facit.} \end{array}$$

for the Proof 84

Further, A Goldsmith has divers Sorts of Gold, viz. some of 24 Carrafts, others of 22 Carrafts, others of 18 Carrafts, and others of 16 Carrafts fine; is desirous to melt as much of all these four Sorts together, as may make a Mass of Gold to contain 16 Ounces of 21 Carrafts fine. Then he proceeds thus:

$$21 \left\{ \begin{array}{l} 24 \\ 22 \\ 18 \\ 16 \end{array} \right. \begin{array}{l} \hline 5 \\ 3 \\ 1 \\ 3 \\ \hline 12 \end{array}$$

$$\text{Oz.} \\ \text{If } 12 \text{ --- } 60 \text{ --- } 5$$

Facit 25 Ounces of the first.

$$\text{Oz.} \\ \text{If } 12 \text{ --- } 60 \text{ --- } 3$$

Facit 15 Ounces of the second.

$$\text{Oz.} \\ \text{If } 12 \text{ --- } 60 \text{ --- } 1$$

Facit 5 Ounces of the third.

$$\text{Oz.} \\ \text{If } 12 \text{ --- } 60 \text{ --- } 3$$

Facit 15 Ounces of the fourth.

which Quantities so taken and mixed, make up the Mass of 60 Ounces of 21 Carrafts fine.

$$\begin{array}{r} \text{Oz.} \\ \text{viz. } 25 \text{ of the first Sort} \\ 15 \text{ of the second Sort} \\ 5 \text{ of the third Sort} \\ 15 \text{ of the fourth Sort} \\ \hline 60 \text{ of } 21 \text{ Carrafts fine.} \end{array}$$

When we calculate on several false Numbers, taken at random, as if they were true ones; and from the Differences found therein, determine the Number sought; such Rule is called in *Arithmetick* the Rule of *False Position*, which I'll demonstrate in this Place.

POSITION is either *Single* or *Double*. *Single Position* is when there happens in the Propositions some Partition of Numbers into Parts proportional, in which Case the Question may be resolved at one Operation by this Rule. Imagine a Number at Pleasure, and work therewith, according to the Tenor of the Question, as if it was the true Number; and

H h h

what

$$\begin{array}{r} \text{add } 56 \\ 127 \frac{1}{2} \\ 130 \\ \hline 313 \frac{1}{2} \\ 2 \\ \hline \text{Dividend } 627 \end{array} \quad \begin{array}{r} 8 \\ 15 \\ 13 \\ \hline 36 \\ 2 \\ \hline \text{Divisor } 72 \end{array}$$

$$\begin{array}{r} \text{Oz.} \\ 72) 627 (8 + \frac{1}{2} \text{ or } \frac{17}{4} \text{ makes } 14 \frac{1}{2} \\ 576 \\ \hline 51 \end{array} \quad \begin{array}{r} \text{Pwt. Gr.} \\ 14 \\ 4 \end{array}$$

Answer, the Mass must be 8 Oz. 14 Pwt. 4 Gr.

Given the Total of a Mixture with the whole Value; and the Value of the several Ingredients, to find the several Quantities mixed though unequally. Multiply the Total of the Mixture by the least Value, subtract the Product from the total Value; and the Remainder is the first Dividend. Then take the said least Value from the greatest valued Ingredient, and the Remainder is the first Divisor. The Quotient of this Division shews the Quantity of the highest-priced Ingredient, and the other is the Complement of the whole. And when more Ingredients than two are in the Composition, the Divisors are the several Remains of the least Value, taken from the other: The Dividends are the Remains left upon the Divisions, till none remain there; which will be one short of the Number of Ingredients; and this defective Ingredient is to be supplied as a Complement; and in Division no more must be taken in every Quotient, than that there may remain enough for the other Divisors; and the last to leave nothing remaining.

Alligation Alternate, is when the Rates or Qualities of several Simples are given; and the Quantity of each is required necessary to make a Mixture of the given Rate or Quality. *Alligation Alternate*, shews the due Proportion of several Ingredients; and counter-changes the Places of such Excesses or Differences as arise between the mean Price and the Extremes; ascribing that to the greater Extreme, which proceeds from the lesser; and contrarily.

The Rules which obtain in *Alligation Alternate*, are these,

First, You must set down the Numbers of which you will make the *Alligation*, orderly one under the other: And the common Number whereinto you must reduce them, set on the Left-hand. Then note which of the said Numbers are lesser than that common Number, and which of them be greater, and with a Draught of your Pen link two Numbers together; so that the least Number may be still linked with the greatest, and the greatest with the smallest. Then add up all these Differences into one Total, which shall be the first Number in the *Rule of Three*, and the second Number the common Number, then the third must be each Difference done by itself. For Example:

A Vintner has four Sorts of low Wine of four several Prizes; the first at 8 d. per Gallon, the second at 10 d. per Gallon, the third at 15 d. per Gallon, and the fourth at 18 d. per Gallon: Now he would mix all these Sorts together, that a Gallon of these (lower, decay'd) Wines may be worth 12 d. the Punccheon holding 84 Gallons. Then:

$$\begin{array}{r} 16 \quad 20 \\ \times 48 \\ \hline 128 \\ 160 \\ \hline 768 \end{array}$$

(24 both Defects work accordingly as per Rule.

$$\begin{array}{r} 16 \\ 2 \\ \hline 32 \end{array}$$

$$\begin{array}{r} 20 \\ 4 \\ \hline 80 \\ 32 \text{ fubtract} \\ \hline 48 \text{ Dividend} \end{array}$$

$$\begin{array}{r} 4 \\ 2 \\ \hline 2 \text{ Divisor} \end{array}$$

2) 48 (24 Years of Age the eldest.
Therefore the Age of the eldest is

24 eldest Son
20 second Son
16 third Son
12 youngest Son

Which answers the Question; for 12 the youngest Son is half the Age of the eldest, viz. 24.

Farther, let it be required to divide 100*l.* among three Persons, viz. *A. B. C.* in such a Manner that the Share of *B.* may be the Triple of the Share of *A.* and 4*l.* over and above; also that the Share of *C.* may be equal to the Sum of the Shares of *A.* and *B.* and 6*l.* over and above. Thus:

Let the first Position for the Share of *A.* be 12, then *B.* must have 40*l.* and *C.* 58*l.* but 12*l.* 40*l.* and 58*l.* is 110*l.* which is 10*l.* too much.

$$\begin{array}{r} 1. \\ 12 \\ 40 \\ 58 \\ \hline 110 \end{array}$$

Then for a second Position I suppose for the Share of *A.* 8*l.* then *B.* must have 28*l.* and *C.* 42*l.* but 8+28+42=78*l.* but this 78*l.* is too little by 22; for if I subtract 78 from 100, there will remain 22, which is too little; therefore this Question, by the Suppositions proves one too little by 22, and the other Supposition 10*l.* too much.

$$\begin{array}{r} 264 + 80 \\ 12 \quad 8 \\ \times 344 \\ \hline 101 + \frac{1}{4} \text{ lb. or } 101.15s. \\ 10 + 22 \\ \hline 32 \end{array}$$

	<i>l.</i>	<i>s.</i>	
Proof <i>A.</i>	10	15	
<i>B.</i>	36	5	
<i>C.</i>	53	0	
	<hr/>		
	100	0	Total.

Farther, A Man gives away his Estate in this Manner, to *A.* $\frac{1}{2}$, and he gave back 10*l.* to *B.* $\frac{1}{3}$, and he gave back 6*l.* and to *C.* $\frac{1}{4}$, and he gave back 4*l.* Last of all he had 16*l.* remaining, what was his Estate?

For Supposition, suppose 60, then

$$\begin{array}{r} 60 \times \frac{1}{2} 30 - 10 = 20 \\ 60 \times \frac{1}{3} 20 - 06 = 14 \\ 60 \times \frac{1}{4} 15 - 04 = 11 \\ \hline 45 \end{array}$$

45+16=61 therefore is 1 too much.

$$\begin{array}{r} 5) 240 (48 \\ 20 \quad 60 \quad 120 \\ \times 48 \\ \hline 240 \\ 40 \\ 40 \\ \hline 0 \end{array}$$

Second Supposition: again, suppose 120*l.* then,

$$\begin{array}{r} 120 \times \frac{1}{2} 60 - 10 = 50 \\ 120 \times \frac{1}{3} 40 - 06 = 34 \\ 120 \times \frac{1}{4} 30 - 04 = 26 \\ \hline 110 \end{array}$$

110+16=126 which is 6 too much

His Estate 848*l.*

Proof

$$\begin{array}{r} 48 \times \frac{1}{2} 24 - 10 = 14 \text{ A.} \\ 48 \times \frac{1}{3} 16 - 06 = 10 \text{ B.} \\ 48 \times \frac{1}{4} 12 - 04 = 08 \text{ C.} \\ \hline 32 + 16 = 48 \text{ l.} \end{array}$$

Having thus far proceeded in *Arithmetick*, the next Thing deserving our Attention is the Doctrine of *Fractions*.

FRACTION in *Arithmetick* is a Part or Division of an Unit or Integer, or a Member which stands to an Unit, in the Relation of a Part to its whole.

Fractions are usually divided into *Decimal*, *Sexagesimal*, and *Vulgar*; but we will take no Notice in this Place, but of *Vulgar Fractions* only.

VULGAR FRACTIONS, called also simply *Fractions*, are always expressed by two Numbers, the one wrote over the other with a Line between them.

The lower, called the *Denominator of the Fraction*, denotes the Unit or whole that is divided into Parts; and the Upper, called the *Numerator of the Fraction*, expresses the Parts given in the present Cases. Thus two third Parts of a Line, or other Things are wrote $\frac{2}{3}$; where the *Denominator* 3 shews that the whole Line is supposed to be divided into three equal Parts; and the *Numerator* 2 indicates or assigns two of such Parts.

Again, twenty-nine Sixtieths is wrote $\frac{29}{60}$, where the *Numerator* 29 expresses 29 Parts of an Integer divided into 60; and the *Denominator* 60 gives the Denomination to these Parts, which are called *Sixtieths*.

The real Design of adding the *Denominator*, is to shew what aliquot Part the broken Number has in Common with Unity. In all *Fractions* as the *Numerator* is to the *Denominator*; so is the *Fraction* itself to the whole, whereof it is a *Fraction*. Thus supposing $\frac{3}{4}$ of a Pound equal to 15*s.* it is evident that 3:4::15:20, whence it follows, That there may be infinite *Fractions* of the same Value one with another; in as much as there may be infinite Numbers found, which shall have the Ratio of 3:4.

Fractions are either *proper* or *improper*. PROPER FRACTION, is that where the *Numerator* is less than the Whole or Integer, as $\frac{3}{4}$. IMPROPER FRACTION, is where the *Denominator* is either equal to or bigger than the *Denominator*; and of Course the *Fraction* equal to or greater than the Whole, or Integer, as $\frac{5}{4}$, or $\frac{7}{4}$, or $\frac{9}{4}$.

Fractions, again, are either *Simple* or *Compound*. SIMPLE FRACTIONS, are such as consist of only one *Numerator*, and one *Denominator*; as $\frac{1}{2}$, or $\frac{3}{4}$, &c. COMPOUND FRACTIONS, called also *Fractions of Fractions*, are such as consist of several *Numerators* and *Denominators*, as $\frac{1}{2}$ of $\frac{1}{3}$ of $\frac{1}{4}$ of $\frac{1}{5}$, &c.

Of *Fractions* these are equal to each other, whose *Numerators* have the same Ratio to their *Denominators*. Those are greater, whose *Numerators* have a greater Ratio; and those less, which have less: Thus $\frac{1}{2} = \frac{2}{4} = \frac{3}{6} = \frac{4}{8} = \frac{5}{10}$. But $\frac{1}{4}$ is greater than $\frac{1}{5}$; and $\frac{1}{5}$ less than $\frac{1}{6}$. Hence if both the *Numerator* and *Denominator* of a *Fraction*, as $\frac{1}{2}$, be multiplied or divided by the same Number 2; the Fact in the former Case, $\frac{2}{4}$, and the Quotients in the latter $\frac{1}{4}$ will constitute *Fractions*, equal to the first *Fraction* given.

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The *Arithmetick* of *Fractions* consists in the *Reduction*, *Addition*, *Subtraction*, and *Multiplication* thereof.

The *REDUCTION* OF *FRACTIONS* is to bring *Integers* into *Fractions*, or contrariwise *Fractions* of divers *Denominations* into one, or what you'll want or desire.

When three or more *Fractions*, which have unequal *Denominators*, are given to be reduced, we must multiply the *Numerator* of each *Fraction*, and all the *Denominators*, except its own, continually one into another; so are the several *Products*, arising from such continual *Multiplication*, a new *Numerator*. And by multiplying all the *Denominators* together continually, the *Product* is a common *Denominator* to all the new *Numerators*. Thus are reduced *proper Fractions*. For Example:

Reduce $\frac{3}{4}$ $\frac{4}{5}$ into one common *Denominator*. Thus:

for three Times 5 is 15, and 4 Times 4 is 16, new *Numerators*, and 4 Times 5 is 20. So that $\frac{15}{20}$ $\frac{16}{20}$ are common *Denominators*, and equal to $\frac{3}{4}$ and $\frac{4}{5}$.

Likewise reduce $\frac{2}{3}$, $\frac{3}{4}$, $\frac{1}{5}$, $\frac{4}{6}$, $\frac{1}{7}$, into one *Denomination*, being reduced *per* our Rule are:

Numerator	15120	18144	25200	13440	36720
Denominator	30240	30240	30240	30240	30240

To reduce *Fractions of Fractions*, the Rule is to multiply all the *Numerators* together, and take the *Product* thereof for a *Numerator*, and likewise to multiply all the *Denominators* together, and make the Total a new *Denominator*. For Example:

Reduce $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ into a *single Fraction*; being reduced it makes $\frac{1}{4}$, and is a *single Fraction*.

$$\frac{\frac{1}{2} \text{ of } \frac{2}{3} \text{ of } \frac{3}{4}}{24}$$

Again reduce $\frac{2}{3}$ of $\frac{4}{5}$ of $\frac{1}{2}$ of $\frac{3}{4}$ of $\frac{2}{5}$, into a *single Fraction*:

Numerator	720	720	720	720
Com. Denominator	6720			

The *Reduction* of *improper Fractions* into whole Numbers, is done in dividing the *Numerator* by the *Denominator*, so is the *Quotient* the whole Number, or mix'd Number sought. For Example:

Reduce $2\frac{2}{5}$ into its equivalent mix'd Number, the Number will be 5 $l.$ $\frac{1}{5}$ or 5 $l.$ 4 $s.$ for if 26 be divided by 5, the *Quotient* is 5 $\frac{1}{5}$.

$$\begin{array}{r} 5)26(5\frac{1}{5} \\ \underline{25} \\ 1 \end{array}$$

Reduce $1\frac{1}{2}$ *facit* 2 $l.$ $\frac{1}{2}$

$$\begin{array}{r} 4)10(2\frac{1}{2} \\ \underline{8} \\ 2 \end{array}$$

Reduce $3\frac{1}{2}$ *facit* 33. $\frac{1}{2}$

$$\begin{array}{r} 12)406(33\frac{1}{2} \\ \underline{36} \\ 46 \\ \underline{36} \\ 10 \end{array}$$

Also the *improper Fraction* $1\frac{1}{2}$ will be reduced into the whole Number 13.

$$\begin{array}{r} 4)52(13 \\ \underline{4} \\ 12 \\ \underline{12} \\ 0 \end{array}$$

To reduce a *mix'd Number*, as $4\frac{1}{2}$ into an *improper Fraction*, of the same Value. Multiply the *Integer* 4, by 12, the *Denominator* of the *Fraction*; and to the *Product* 48 add the *Numerator*; the Sum 59, set over the former *Denominator* $\frac{1}{2}$, constitutes the *Fraction* required.

To reduce a *whole Number* into an *improper Fraction*, multiply the given Number by the intended *Denominator*, and place the *Product*, for a *Numerator* over it. For Example:

Reduce 15 into a *Fraction*, whose *Denominator* shall be 12. *Facit* $1\frac{5}{4}$ for 15 multiplied by 12 *Facit* $1\frac{5}{4}$.

$$\begin{array}{r} 15 \\ 12 \\ \hline 180 \end{array}$$

To find the Value of a *Fraction* in the known Parts of its *Integer*. Suppose e. g. it were required to know what is $\frac{2}{5}$ of a Pound; multiply the *Numerator* 2 by 20, the Number of known Parts in a Pound, and divide the *Product* by the *Denominator* 16, the *Quotient* gives 11 $s.$ Then multiply the *Remainder* 4 by 12, the Number of known Parts in the next inferior *Denomination*; and dividing the *Product* by 16, as before, the *Quotient* is 3 $d.$ So that $\frac{2}{5}$ of a Pound = 11 $s.$ 3 $d.$

Thus much for *Reduction of Fractions*. We'll proceed now to *Addition*.

ADDITION of vulgar Fractions. 1. If the given *Fractions* have different *Denominators*, reduce them to the same; then add the *Numerators* together, and under the Sum write the common *Denominator*. Thus, for Example.

$$\frac{2}{3} + \frac{4}{5} = \frac{10}{15} + \frac{12}{15} = 1\frac{22}{15} \text{ and } \frac{2}{3} + \frac{1}{6} + \frac{1}{3} + \frac{4}{6} + \frac{1}{2} + \frac{1}{2} = 1\frac{1}{2} = 1\frac{1}{2}$$

2. If *Compound Fractions* are given to be added; they must first be reduced to simple ones; and if the *Fractions* be of different *Denominations*, as $\frac{2}{5}$ of a Pound, and $\frac{1}{2}$ of a Shilling, they must first be reduced to *Fractions* of the same *Denomination* of Pounds.

3. To add *mixed Numbers*: The *Integers* are first to be added; then the *fractional Parts*; and if their Sum be a *proper Fraction*, only annex it to the Sum of *Integers*. If it be an *improper Fraction*, reduce it to a *mixed Number*, adding the *integral Parts* thereof to the Sum of *Integers*, and the *fractional Part* after it. Thus, $5\frac{2}{3} + 4\frac{1}{3} = 10\frac{1}{3}$.

For the *SUBTRACTION of Fractions*. The Rule is — when the Numbers given are both *single Fractions*, and have one and the same *Denominator*, to subtract the lesser *Denominator* from the greater, and place the *Remainder* over the common *Denominator*, so is such new *Fraction* the *Difference* between the *Fractions* given. For Example:

Subtract $\frac{1}{2}$ from $\frac{3}{2}$, the *Difference* is $\frac{2}{2}$, or 1.

But when they have unequal *Denominators*, they must be reduced into *Fractions* of the same Value, which shall have a common *Denominator*, and then find the *Difference*. For Example:

Subtract $\frac{1}{2}$ from $\frac{3}{4}$ rest $\frac{1}{4}$, for $\frac{3}{4}$ and $\frac{1}{2}$, being reduced,

duced, will $\frac{4}{5}$ and $\frac{4}{5}$, so the Difference you see to be $\frac{1}{5}$.

When one of the Numbers given is a whole Number, or a mixt Number, or if either of them are mixed Numbers, reduce such whole or mixt Numbers into an improper *Fraction*, or *Fractions*, and then work as before.

Subtract $7\frac{3}{5}$ from 12, the Remainder is found $4\frac{2}{5}$, for these two *Fractions* will be found to be $\frac{3}{5}$, and $\frac{2}{5}$, whose Difference is $\frac{1}{5}$ or $4\frac{2}{5}$.

In like Manner $3\frac{2}{3}$, being to be subtracted from $5\frac{1}{3}$, the Remainder will be found $2\frac{1}{3}$, or $2\frac{1}{3}$, as by the subsequent Operation.

$\begin{array}{r} 12 \\ 5\frac{3}{5} \\ \hline 69 \\ 44 \\ \hline 25 \end{array}$	$\begin{array}{r} 12 \\ 3\frac{2}{3} \\ \hline 12 \text{ Denom.} \end{array}$
<p>So there is $\frac{2}{3}$, or $2\frac{1}{3}$, as before.</p>	
<p>For 4 multiplied by 3 is 12 for Numerator.</p>	

From 12 take $7\frac{3}{5}$ Thus:

$\begin{array}{r} 12 \\ 5 \\ \hline 60 \\ 33 \\ \hline 22 \end{array}$	<p>Rest $\frac{2}{5}$</p>
<p>For Answer remains $4\frac{2}{5}$, or $4\frac{2}{5}$.</p>	

When a whole Number is given to be subtracted from a mixt Number, subtract the said whole Number from the whole Part of the mixt Number; and unto the Remainder annex the fractional Part of the mixt Number given, so is the mixt Number so found the Difference sought. For Example:

Received $\frac{2}{7}$ of a Pound, laid out 7 Pounds, what remains?

$\begin{array}{r} 24 \\ 7 \text{ Subtract} \\ \hline 17 \end{array}$	<p>$\frac{5}{7}$ Remains.</p>
--	--

When a *Fraction* is given to be subtracted from an *Integer*, subtract the Numerator from the Denominator, and place that which remains over the Denominator, which new *Fraction* is the Difference sought. So $\frac{1}{2}$ being subtracted from an *Integer*, or 1, the Remainder is $\frac{1}{2}$.

When a *Fraction* is given to be subtracted from a whole Number greater than 1, subtract the said *Fraction* from one of the *Integers* given by the last Rule; the remaining *Fractions* being annexed to the Number of *Integers* lessened by 1, will give the Remainder. Thus $\frac{1}{2}$ being subtracted from 6, the Remainder is $5\frac{1}{2}$.

To subtract a whole Number and a *Fraction* from a whole Number and a *Fraction*, the *Fractions* must be first reduced into one Denomination, then one Numerator subtracted from the other; and the *Integers* subtracted, as in whole Numbers. For Example:

Received $30\frac{1}{4}$, laid out $10\frac{1}{4}$, first reduce $\frac{1}{4}$ and $\frac{1}{4}$ into one Denomination.

$\begin{array}{r} 30\frac{1}{4} \\ 10\frac{1}{4} \\ \hline 20 \end{array}$	<p>Rest $20\frac{1}{4}$</p>
--	--

When *Fractions of Fractions* are to be subtracted, they are to be reduced into single *Fractions*, then subtract as before.

Subtract $\frac{1}{2}$ of $\frac{2}{3}$ from $\frac{3}{4}$ of $\frac{4}{5}$. Being reduced they are $\frac{1}{2}$ and $\frac{2}{3}$

$\begin{array}{r} 4 \\ 5 \quad 9 \\ \hline 15 \end{array}$	<p>Rest $\frac{4}{5}$</p>
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Those *Fractions* are always accounted the greatest, whose Numerator multiplied by the Denominator of the other *Fraction* makes the greatest Number. Thus $\frac{2}{3}$ is greater than $\frac{1}{2}$; for 7 Times 5 is greater than 8 Times 3.

In *Multiplication of Vulgar Fractions*. 1. If the *Fractions* proposed be both simple, multiply the Numerators one by another for a new Numerator, and the Denominators for a new Denominator. Thus $\frac{3}{4}$ into $\frac{5}{8}$ produces $\frac{15}{32}$.

We must observe in this Place, that as whole Numbers multiplied by whole Numbers increase the Product; so proper *Fractions* multiplied by proper *Fractions* diminish the Product. For as 1 multiplied by 1 makes but 1, so that which is less than 1 being multiplied by $\frac{2}{3}$ of a Pound makes but $\frac{2}{3}$ a Pound $\frac{2}{3}$ by $\frac{2}{3}$ = $\frac{4}{9}$ or $\frac{4}{9}$.

2. If one of them be a mix'd or whole Number, it must be reduced to an improper *Fraction*, and then proceed as in the last Rule. Thus $7\frac{1}{2}$ being multiplied by $5\frac{3}{5}$, the Product will be found 42.

$\begin{array}{r} 7\frac{1}{2} \text{ by } 5\frac{3}{5} \\ 2 \quad 5 \\ \hline 15 \quad 28 \\ 2 \quad 5 \end{array}$	<p>for 28 by 2</p> $\begin{array}{r} 15 \\ 5 \\ \hline 10 \end{array}$
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Though there may be other Rules for the Multiplication of mixed Numbers, that used by Joiners, Carpenters, and Bricklayers, commonly called *Cross Multiplication*, is at present very much in Use. Thus if it be required to multiply 120 Feet $\frac{1}{4}$ by 48 Feet $\frac{1}{2}$, first multiply the whole Numbers continually; thus 120 by 48, and place the Product orderly one under the other.

Thus the whole Numbers make 5760, then multiply alternately, or Cross-ways, viz. take $\frac{1}{4}$ of 48, which is 12, also take $\frac{1}{2}$ of 120, which is 60, orderly to be added to the former. Lastly, Add all together, and to the Sum add the Product of the two *Fractions*, as in this Example, the Product of the Multiplication of $\frac{1}{4}$ by $\frac{1}{2}$, which is $\frac{1}{8}$, so the Total Product required will be $5832\frac{1}{8}$, as you see by the Operation in the Margent.

$\begin{array}{r} 120 \\ 48 \\ \hline 960 \\ 480 \\ \hline 5760 \\ 12 \\ 60 \\ \hline 5832\frac{1}{8} \end{array}$
--

In like Manner multiply $4\frac{1}{2}$ by $4\frac{1}{2}$ or 4 s. 6 d. by 4 s. 6 d.

$\begin{array}{r} 4\frac{1}{2} \\ 4\frac{1}{2} \\ \hline 16 \\ 2 \\ 2\frac{1}{4} \\ \hline 20\frac{1}{4} \end{array}$	<p>s. d.</p> $\begin{array}{r} 4 \quad 6 \text{ by } 4 \text{ s. } 6 \text{ d.} \\ 4 \quad 6 \\ \hline 16 \\ 2 \\ 2\frac{1}{4} \\ \hline 20 \cdot 3 \end{array}$
---	--

For by multiplying Cross-ways, saying 6 Times 4 is 24 d. which is 2 s. and so alternately again it is 2 s. and the *Fraction* being $\frac{1}{4}$ of a Shilling is 3 d. so that 4 s. 6 d. multiplied by 4 s. 6 d. is 20 s. 3 d.

In like Manner multiply 3 Feet 6 Inches by 3 Feet 6 Inches.

$$\begin{array}{r} \text{Feet} \\ 3 \frac{1}{2} \\ 3 \frac{1}{2} \\ \hline 9 \\ 1 \frac{1}{2} \\ 1 \frac{1}{2} \\ \hline 12 \frac{1}{4} \end{array}$$

Facit 12 Feet $\frac{1}{4}$

Operation by *Fractions* by the last Rule.

l. s. d.		5 d. is $\frac{5}{12}$ of $\frac{1}{2}$ viz. $+\frac{5}{24}$
5 5 5		
20	105	20
105	240	5
20		
20	4200	100
400	210	
12	25200	
4800 New Den.	100	
	253 00 New Num.	
	48 00	

48	$\frac{253}{48}$ by $\frac{253}{48}$	253
48		253
2304		759
		1265
		506
		64009

Answer $\frac{64009}{2304}$ equal to 27 l. 15 s. 7 d. $\frac{1}{2} \frac{1}{2}$.

The Proof of this Question by the Rule of Three Direct.

l.	l. s. d.	l. s. d.
1	5 5 5	5 5 5
20	20	20
20	105	105
12	12	12
240	1265	1265
		1265
		6325
		7590
		2530
		1265
		1600225

240)	1600225	12	(6667 (55 5
	1440	60	
	1602	66	27 15 : 7 : $\frac{1}{2} = \frac{1}{2} + \frac{1}{2}$
	1440	60	
	1622	67	
	1440	60	
	1825	7	
	1680		
	145		

For the *Division of Fractions*. 1. If the *Fractions* proposed be both simple, multiply the Denominator of the Divisor, by the Numerator of the Dividend; the Product is the Numerator of the Quotient. Then multiply the Numerator of the Divisor by the Denominator of the Dividend, the Product is the Denominator of the Quotient. Thus $\frac{1}{2} \div \frac{1}{3} = \frac{3}{2}$.

2. If either Dividend, Divisor, or both, be whole or mixed Numbers, reduce them to improper *Fractions*; and if they be compound *Fractions*, reduce them to simple ones; and proceed as in the first Rule.

In *Division of Fractions*, observe that the Quotient is always greater than the Dividend; because in all Division, as the Divisor is to the Unity, so is the Dividend to the Quotient; as if 3 divide 12, it will be as 3:1::12:4. Now 3 is greater than 1; wherefore 12 must be greater than 4: But in *Fractions*, as $\frac{3}{2} : 1 :: \frac{4}{2} : \frac{3}{2}$; where $\frac{3}{2}$ is less than 1; wherefore $\frac{4}{2}$ must also be less than $\frac{3}{2}$.

To work the Rule of Three in *Vulgar Fractions*, the Denominator of the first Number must be multiplied by the Numerator of the second; then that Product multiplied by the Numerator of the third Number, and the Product reserved for a new Numerator. That done, the Numerator of the first Number must be multiplied by the Denominator of the second; and the Product multiplied by the Denominator of the third, which Product will become a new Denominator. This new *Fraction* so sought is the Answer to the Question, which said *Fractions*, whether proper, improper, or mixt *Fractions*, may be reduced into its equivalent *Fractions*, as before thought. For Example:

If $\frac{3}{4}$ of a Yard cost $\frac{5}{6}$ of a Pound what will $\frac{7}{8}$ of a Yard.

$\frac{3}{4}$	$\frac{5}{6}$	$\frac{7}{8}$
5	3	
20	18	
7	8	
Num. 140	Denom. 144	$\frac{140}{144} = \frac{35}{36}$

Answer $\frac{35}{36}$ or $\frac{7}{8}$.

Further: If 3 Yards of broad Cloth cost 2 l. $\frac{1}{2}$ what will 14 $\frac{3}{4}$ Yards Cost.

Yards	l.	Yards
3	2 101	14 $\frac{3}{4}$ cost
5	14	
15	404	$\frac{140}{144}$ of a Pound, equal to 13 l. 9 s. 9 d.
7	101	
105	1414	

Thus proved by reducing your *Fraction* as before thought.

l. s. d.
105) 1414 (13 9 4
105
364
315
49
20
105) 980 (9
945
35
12
105) 420 (4
420
0

By this Operation 'tis evident, that $\frac{105}{1414}$ is equal to 13 l. 9 s. 4 d.

Having thus clearly demonstrated the *Arithmetick* of whole Numbers and broken Numbers, commonly called *Vulgar Fractions*, I proceed to that excellent Invention called *Decimal Arithmetick*, first invented by *Johannes Regiomontanus*, and used by him in his Tables of Signs.

Decimal Fractions, are those whose Denominator is 1, with one or more Cyphers; as 10, 100, 1000, 10,000, &c. Thus $\frac{5}{10}$, $\frac{46}{100}$, $\frac{125}{1000}$, &c. are *Decimal Fractions*.

In the Writing of *Decimal Fractions*, we usually omit the Denominator, as only consisting of Unity with Cyphers annexed; and in Lieu thereof a Point, or Comma is prefixed to the Numerator. Thus $\frac{5}{10}$ is wrote .5; $\frac{46}{100}$, 46. so .125 expresses an Hundred twenty-five Parts of any Thing supposed to be divided into 1000 Parts.

As Cyphers on the right Hand of Integers do increase their Value *Decimally*; as 2, 20, 200, &c. so when set on the left Hand of *Decimal Fractions*, they decrease the Value *Decimally*; as 5, 05, 005, &c. when set on the left Hand of Integers, or on the right Hand of *Decimals*, they signify nothing but only to fill up Places; thus 5000, or 0005, is but five Units.

To reduce *Vulgar Fractions* into *Decimals*, add Cyphers at Pleasure to the Numerator, and divide by the Denominator. Thus $\frac{5}{8}$, being propounded to be reduced to a *Decimal*, will be changed into .625, that is $\frac{625}{1000}$, for annexing Cyphers unto the Numerator 5, it will be 5000, which being divided by the Denominator 8, the Quotient will be 625, before which, prefixing a Point, it will be .625, that is $\frac{625}{1000}$ the *Decimal* sought; as it appears in the Operation.

$$\begin{array}{r} 8) 5000 (625 \\ 48 \\ \hline 20 \\ 16 \\ \hline 40 \\ 40 \\ \hline 0 \end{array}$$

The common Operations in *Decimals*, are perform'd as in the vulgar Rules, Regard being had only to the particular Notation, to distinguish the integral from the fractional Part of a Sum.

In *Addition*, and *Subtraction* of *Decimal Fractions*; the Points being all placed under each other, the Figures are to be added; or subtracted as in common *Arithmetick*: And when the Operation is done, so many Figures of the Sum, or the Remainder are to be noted for *Decimals*, as there are Places of *Decimals* in the greatest given Number, an Example will make this clear.

Addition of <i>Decimals</i> .		Subtraction.
.43791		from 67.9
.792	59.271	take 29.8754
.6124	15.040	Rem. 38.0246
.053	3.791	
.10	12.009	from 25.1462
.2	7.5	take 13.07
2.19531	97.062	Rem. 12.0762

For *MULTIPLICATION* of *Decimals*, the Rule is, so often as two Numbers are given to be multiplied, and are both mixt Numbers, or both *Decimal Fractions*, or one of them a whole Number, and the other a *Decimal* or mixt Number, to write them down exactly one underneath the other, as is done in Multiplication of whole Numbers; and when you have gotten the Product, to see how many Places of

Fractions are found both in the Multiplicand and Multiplier jointly, just so many Places you must cut off from the Product, by a Point, Comma, or Line towards the Right-hand, as there are Places of *Decimals* in both Factors. Thus,

$$\begin{array}{r} \text{Multiply } 246.25 \\ \text{by } 35 \\ \hline 123125 \\ 73875 \\ \hline 8618.75 \end{array} \quad \begin{array}{r} .87 \\ .9 \\ \hline .783 \end{array}$$

When the *Multiplication* is finished, if there arise not so many Places in all, as ought to be cut off, (which may often happen when the Product is a *Fraction*) in such Case as many Places as are wanting, so many Cyphers must be prefixed to the Product, on the Left-hand thereof, to compleat the Product. For Example;

$$\begin{array}{r} \text{Multiply } .0375 \text{ by } .05 \\ \hline .05 \\ \hline 1875 \end{array}$$

Now here being but four Figures, I prefix two Cyphers to compleat the Product of

$$\begin{array}{r} \text{Multiply } .0375 \text{ is } .001875 \text{ Product} \\ \text{by } .05 \end{array}$$

Product is .001875 as by Rule.

In *DIVISION* of *Decimals*, proceed in all Respects as in dividing of Integers; and when the Operation is done, mark as many Places in the Quotient for *Decimals*, as with the Number of *Decimals* in the Divisor, are equal to the *Decimal* Places of the Dividend.

$$\begin{array}{r} .22) .8030 (3.65 \\ 66 \\ \hline 143 \\ 132 \\ \hline 110 \\ 110 \\ \hline 0 \end{array}$$

$$\begin{array}{r} 22) 8.030 (365 \\ 66 \\ \hline 143 \\ 132 \\ \hline 110 \\ 110 \\ \hline 0 \end{array}$$

$$\begin{array}{r} 22) .8030 (.0365 \\ 66 \\ \hline 143 \\ 132 \\ \hline 110 \\ 110 \\ \hline 0 \end{array}$$

$$\begin{array}{r} 73.2) 8321.9 (1.13 \\ 732 \\ \hline 1002 \\ 732 \\ \hline 2709 \\ 2196 \\ \hline 513 \end{array}$$

But there are certain Cases in *Division* of *Decimals*, which require some further Management: as first, where the Divisor is a *Decimal Fraction*, and the Dividend an Integer; add or annex as many or rather more Cyphers to the Dividend, than there are Places in the Divisor: Thus,

$$.365) 22.0000 (60.2$$

For there being three Places of *Decimals* in the Divisor, and four in the Dividend, there will be but one in the Quotient.

2. Where the Divisor is a mixt Number, and the Dividend a whole Number, add, at least, as many Cyphers

Cyphers to the Dividend, as there are Places in the Divisor. Thus,

$$3.65)22.0000(6.02$$

3. Wherever the Divisor is bigger than the Dividend, annex Cyphers to the latter. Thus,

$$.365)22.0000(.602$$

To work the RULE OF THREE in *Decimals*, the Operations are the same as in whole Numbers, only in *Decimals* Respect must be had to the *Decimal* Rules before taught, especially when you come to the Answer in your Quotient, by duly separating the *Decimals* from the Integers. For Example,

If 9lb. $\frac{1}{2}$ of Coffee cost 3 l. 15 s. how much will 278 lb. $\frac{1}{2}$ cost?

Note, When the fractional Parts of the Numbers in this Question are converted into *Decimals*, then they will stand thus,

If 9.25 lb. of Coffee cost 3.75 l. what will 278.5 lb. of Coffee cost.

$$\begin{array}{r}
 278.5 \\
 3.75 \\
 \hline
 13925 \\
 19495 \\
 8355 \\
 \hline
 1044375 \\
 9.25)1044375(112.9 \\
 \underline{925 \dots} \\
 1193 \\
 \underline{925} \\
 2687 \\
 \underline{1850} \\
 8375 \\
 \underline{8325} \\
 50
 \end{array}$$

Answer 112 l. 9 s. 1 d. +

Further, If 9 C. wt. of Sugar cost 25 l. 7 s. what will be the Price of 17 C. wt.?

$$\begin{array}{r}
 \text{C.} \qquad \qquad \text{l.} \qquad \qquad \text{C.} \\
 9 \text{ --- } 25.35 \text{ --- } 17 \\
 \qquad \qquad \underline{17} \\
 \qquad \qquad 17745 \\
 \qquad \qquad \underline{2535} \\
 9)430.95(47.88 \\
 \underline{36 \dots} \\
 70 \\
 \underline{63} \\
 79 \\
 \underline{72} \\
 75 \\
 \underline{72} \\
 3
 \end{array}$$

Answer 47 l. 17 s. 8 d.

Decimals are of a very great use in the Mensuration of Superficies and Solids, which is accomplish'd in the following Manner, viz.

There is a Chamber whose Floor is 22 Feet 9 Inches long, and 9 Feet 6 Inches broad, what is the Content in Feet and Inches? Thus *Decimally*,

Length 22.75 Feet and Breadth 9.5 Feet what is the Content? *

$$\begin{array}{r}
 22.75 \\
 9.5 \\
 \hline
 11375 \\
 20475 \\
 \hline
 216.125
 \end{array}$$

Answer 216 Feet and $\frac{1}{8}$ of an Inch.

Further, How many Yards of Wainscot does that Room require, whose Height is 12 Foot 3 Inches, and Compa's 104 Feet 6 Inches?

3 Inches in *Decimals* is .25
6 Inches in *Decimals* is .5

Therefore multiply 104.5
by 12.25

$$\begin{array}{r}
 5225 \\
 2090 \\
 2090 \\
 1045 \\
 \hline
 \text{In Feet } 1280.125
 \end{array}$$

To answer the Question in Yards.

Divide by 9)1280.125(142.236

$$\begin{array}{r}
 9 \dots \\
 \hline
 38 \\
 36 \\
 \hline
 20 \\
 18 \\
 \hline
 21 \\
 18 \\
 \hline
 32 \\
 27 \\
 \hline
 55 \\
 54 \\
 \hline
 1
 \end{array}$$

Answer 142 Yards, $\frac{236}{1000}$ Feet; or 142 Yards, 2 Feet, 3 Inches.

To find the Length of the Circumference of a Circle, the Diameter being known. Let there be a Circle whose Diameter is 42, what is the Length of the Circumference?—Multiply always the Diameter by 22, and divide the Product by 7, your Quotient is the Answer. Thus

$$\begin{array}{r}
 42 \\
 22 \\
 \hline
 84 \\
 84 \\
 \hline
 7)924(132 \\
 \dots \\
 0
 \end{array}$$

Answer 132.

The Circumference being given, to find the Diameter as in the former Circle, the Circumference being 132, and the Diameter required.—The Circumference must be multiplied by 7, and the Product divided by 22, and the Quotient is the Diameter. Thus,

Circumference 132
7

22)924(42 the Diameter required.
88
44
44
0

The Diameter of a Circle being given to find the Area, or Content thereof. Multiply the Diameter by itself; again, multiply by 11, and divide by 14, and your Operation is perfect. Thus,
The Diameter 42 the Content of the Circle required.

Diameter 42
multiply'd by 42
84
168
1764
multiply'd by 11
1764
1764

Divide by 14)19404(1386 Content required.
14...
54
42
120
112
84
84
0

Having thus compleated our *Arithmetick*, either of *Integers* or *Fractions*, both *Vulgar* and *Decimal*, we mult proceed to the Extraction of *Square* and *Cube Roots*.

SQUARE ROOT is a Number considered, as the Root of a second Power or *Square Number*; or a Number by whose Multiplication, into itself, a Square Number is generated; which Square Number is the Product of a Number multiplied by itself. Thus 4 the Product of 2 multiplied by 2; or 16 the Product of 4 multiplied by 4, are Square Numbers; therefore the Number 2, being that by whose Multiplication by itself, the Square Number 4 is produced; is in respect hereof called a *Square Root*, or the *Square Root* of 4. Since as Unity is to the *Square Root*, so is the *Root* to the Square Number.

For the Extraction of *Square* and *Cube Roots*, they have the Squares and Cubes of all Digits in Readiness, as exhibited in the following Table.

Roots	1	2	3	4	5	6	7	8	9
Square	1	4	9	16	25	36	49	64	81
Cubick	1	8	27	64	125	216	343	512	729

To extract a *Square Root* out of a given Number.
1. Divide the given Number into Classes of two Figures a Piece; and include each Class between two Dots, commencing with the Place of Units, or the Right-hand Figure; the Root will consist of so many Parts or Figures as you have Classes. By the Way observe, it may happen that for the last Class, on the Left-hand there shall only be one Figure left.

2. Then the Left-hand Class being the Square of the first Figure of the Root sought; look in the

Table of Roots for the square Figure answering to that Number: Or if that square Number be not precisely there, to the next lesser Number: This Root write down for the first Figure of the Quotient, and subtract its Square from the Left-hand Class to the Remainder, bring down the next Class toward the Right.

3. Write down the Double of the Quotient-figure, under the Left-hand Figure of the second Class; and seek how oft the Decuple is contained in the Figure over it: The Quotient gives the second Figure of the Root.

4. Write the same Quotient under the Right-hand Figure of the same Class; and subtract the Product of the whole Number underwritten, multiplied by the first Figure of the Root, from the Number over it, as in Division.

5. The Operation being repeated according to the third and fourth Steps, that is to say, the Remainder being still divided by the Double of the Root as far as *extracted*, and from the Remainder, the Square of the Figure that last came out, with the Decuple of that aforesaid Divisor augmented thereby, being subtracted; you will have the Root required. For Example:

Note, That by *Decuple* is understood a Term of Relation or Proportion, implying a Thing to be ten Times as much as another.

To *Extract* the Root of 99856, point it after this Manner, 99856, then seek a Number whose Square shall equal the first Figure 9, viz. 3, and write it in the Quotient; then having subtracted from 9, 3×3 , or 9, there will remain 0; to which set down the Figures as far as the next Point, viz. 98 for the following Operation.

99856(316
9
098
61
3756
3756
0

Then taking no Notice of the last Figure 8, say, how many Times is the Double of 3, or 6, contained in the first Figure 9? Answer 1, wherefore having wrote one in the Quotient, subtract the Product of 1×61 , or 61 from 98, and there will remain 37, to which connect the last Figure 56, and you will have the Number 3756 on which the Work is next to be carried on. Wherefore also neglecting the last Figure of this, viz 6, say, how many Times is the double of 31 or 62 contained in 375, (which may be guessed at from the initial Figure 6, and 37, by taking Notice how many Times 6 is contained in 37;) Answer 6; and writing 6 in the Quotient, subtract 6×626 , or 3756, and there will remain 0; whence it appears that the Business is done, the Root coming out 316.

Otherwise, with the Divisors set down, it will stand thus:

99856(316
9
6) 98
61
62) 3756
3756
0 and so in others

Again, if you was to extract the Root of 22178791: First having pointed, seek a Number, whose Square (if it cannot be exactly equalled) shall be the next less square, (or nearest) to 22, the Figures to the first Point, and you will find it to be 4, for 5×5 , or 25, is greater than 22; and 4×4 , or 16, is less; wherefore 4 will be the first Figure of the Root. This therefore being writ in the Quotient, from 22, take the Square 4×4 , or 16; and to the Remainder 6, adjoin the next Figures 17, and you will have 617; from whose Division, by the Double of 4, you are to obtain the second Figure of the Root, viz. neglecting the last Figure 7, say, how many Times 8 is contained in 61? Answer 7; wherefore write 7 in the Quotient, and from 617 take the Product of 7 into 87, or 609, and there will remain 8, to which join the two next Figures 87, and you will have 887; by the Division whereof by the Double of 47, or 94, you are to obtain the third Figure; in order to which, say, how many Times is 94 contained in 88? Answer 0; wherefore write 0 in the Quotient, and adjoin the two last Figures 91, and you will have 88791, by whose Division by the Double of 470, 940, you are to obtain the last Figure, viz. say, how many Times 940 in 8879? Answer 9; wherefore write 9 in the Quotient, and you will have the Root 4709. But since the Product 9×9409 , or 84681 subtracted from 88791 leaves 4110, the Number 4709 is not the Root of the Number 22178791 precisely, but a little less.

$$\begin{array}{r}
 22178791 \text{ (4709,43637, \&c.)} \\
 16 \\
 \hline
 617 \\
 609 \\
 \hline
 88791 \\
 84681 \\
 \hline
 411000 \\
 376736 \\
 \hline
 3426400 \\
 2825649 \\
 \hline
 60075100 \\
 56513196 \\
 \hline
 356190400 \\
 282566169 \\
 \hline
 73624231
 \end{array}$$

If then it be required to have the Root approach nearer; carry on the Operation in Decimals, by adding to the Remainder two Cyphers in each Operation; thus the Remainder 4110, having but two Cypher added to it, becomes 411000; by the Division whereof, by the Double of 4709, or 9418, you will have the first Decimal Figure 4; then having writ 4 in the Quotient, subtract 4×94184 , or 376736, from 411000, and there will remain 3426; and so having added two more Cyphers, the Work may be carried on at Pleasure, the Root at Length coming out 4709.43637, &c.

But when the Root is carried on half Way or above, the rest of the Figures may be obtained by Division alone: As in this Example, if you had a Mind to *extract* the Root to nine Figures, after the five former 47094 are *extracted*, the four latter may be had, by dividing the Remainder by the Double of 47094.

Thus if the Root of 32976, were to be extracted to five Places, in Numbers; after the Figures are pointed, write 1 in the Quotient, as being the Figure whose Square 1×1 , or 1, is the greatest that is contained in 3, the Figure to the first Point; and having

taken the Square of 1 from 3, there will remain 2; then having set the two next Figures, viz. 29 to it, (viz. to 2,) seek how many Times the Double of 1, viz. 2 is contained in 22, and you will find indeed that it is contained more than ten Times; but you are never to take your Divisor 10 Times, no, nor 9 Times in this Case; because the Product of 9×29 , or 261, is greater than 229, from which it should be taken, or subtracted: Wherefore write only 8, and then having wrote 8 in the Quotient, and subtracted 8×28 , or 224, there will remain 5, and having set down to this the Figures 76, seek how many Times the Double of 18, or 36, is contained in 57, and you will find 1, and so write 1 in the Quotient; and having subtracted 1×361 , or 361 from 576, there will remain 215. *Lastly*, To obtain the remaining Figures, divide this Number 215, by the Double of 181, viz. 362, and you will have the Figures 59, which being writ in the Quotient, give the Root 181,59. Thus:

$$\begin{array}{r}
 32976(181,59 \\
 \hline
 1 \\
 \hline
 2)229 \\
 224 \\
 \hline
 36)576 \\
 361 \\
 \hline
 362)215(59, \&c.
 \end{array}$$

After the same Manner are *Roots* extracted out of Decimal Numbers. Thus the Root of 329,76 is 18,159; and the Root of 3,2976 is 1,8159; and the Root of 0,032976, is 0,18159, and so on. But the Root of 3297,6 is 57,4277; and the Root of 32,976 is 574247; and thus the Root of 9,9856 is 3,16.

Before we proceed to the *Extraction of Cube Roots*, we must understand what's a *Cube* or *Cubic Root*.

A *CUBE ROOT*, is the Origin of a *Cubic Number*, which *Cubic Number* is a Number arising from the Multiplication of a square Number by its *Root*. Thus if the square Number 4 be multiplied by its *Root* 2, the Factum 8 is a *Cube*, or *Cubic Number*; and the Number 2, with Respect thereto a *Cube Root*. Hence, since, as Unity is to the *Root*, so is the *Root* to the *Square*; and as Unity is to the *Root*, so is the *Square* to the *Cube*; the *Root* will also be to the *Square*, as the *Square* to the *Cube*; that is, Unity, the *Root*, the *Square*, and the *Cube* are in continual Proportion; and the *Cube Root* is the first of two Numbers that are mean Proportionals between Unity and the *Cube*.

A *Cube Number* is either Simple or Compound. The simple *Cube Numbers*, together with their respective *Roots* are expressed in the Table at the Beginning of *Extraction of Square Roots*.

A *COMPOUND CUBE NUMBER*, is that which being produced by itself, is never less than 1000, so 405224 is a *compound Cube Number*, being produced by thus:

$$\begin{array}{r}
 74 \\
 74 \\
 \hline
 296 \\
 518 \\
 \hline
 5476 \text{ the Square}
 \end{array}
 \qquad
 \begin{array}{r}
 5476 \\
 74 \\
 \hline
 21904 \\
 38332 \\
 \hline
 405224 \text{ Cube Number}
 \end{array}$$

The *Extraction of the Cubic Root*, and of all other *Roots* may be comprehended under one general Rule, viz. every third Figure beginning from Unity, is first to be pointed, if the *Root* to be extracted be a *Cubic*; or every fifth, if it be a *Quadrato Cubic*, (or of the fifth *Power*), and then such a Figure is to be writ in the Quotient, whose greatest *Power* (that is, whole *Cube*, if it be a *Cubic Power*, or whole *Quadrato Cubic*, if it be the fifth *Power*) shall either be equal to the

Now to proceed on the *Extraction of Cube Roots*. To extract the *Cube Root* of 13312053, the Number is first to be pointed after this Manner, *viz.* 13312053, then you are to write the Figure 2, whose *Cube* is 8 in the first Place of the Quotient, as, that which is the next lesser *Cube* to the Figures 13 (which is not a perfect *Cube Number*) or as far as the first Point; and having subtracted the *Cube*, there will remain 5; which being augmented by the next Figure of the Resolvend 3, and divided by the triple Square of the Quotient 2, by seeking how many Times 3×4 , or 12, is contained in 53, it gives 4 for the second Figure of the Quotient. But since the *Cube* of the Quotient 24, *viz.* 13824, would come out too great to be subtracted from the Figures 13312, that precede the second Point, there must only 3 be writ in the Quotient; then the Quotient 23 being in a separate Place multiplied by 23 gives the Square 529, which again multiplied by 23, gives the *Cube* 12167, and this taken from 13312, will leave 1145; which augmented by the next Figure of the Resolvend 0, and divided by the triple Square of the Quotient 23, *viz.* by seeking how many Times 3×529 , or 1587, is contained in 11450, it gives 7 for the third Figure of the Quotient. Then the Quotient 237, multiplied by 237, gives the Square 56169, which again multiplied by 237, gives the *Cube* 13312053, and this taken from the Resolvend, leaves 0. Whence it is evident that the *Root* sought is 237, as it appears in the following whole Operation.

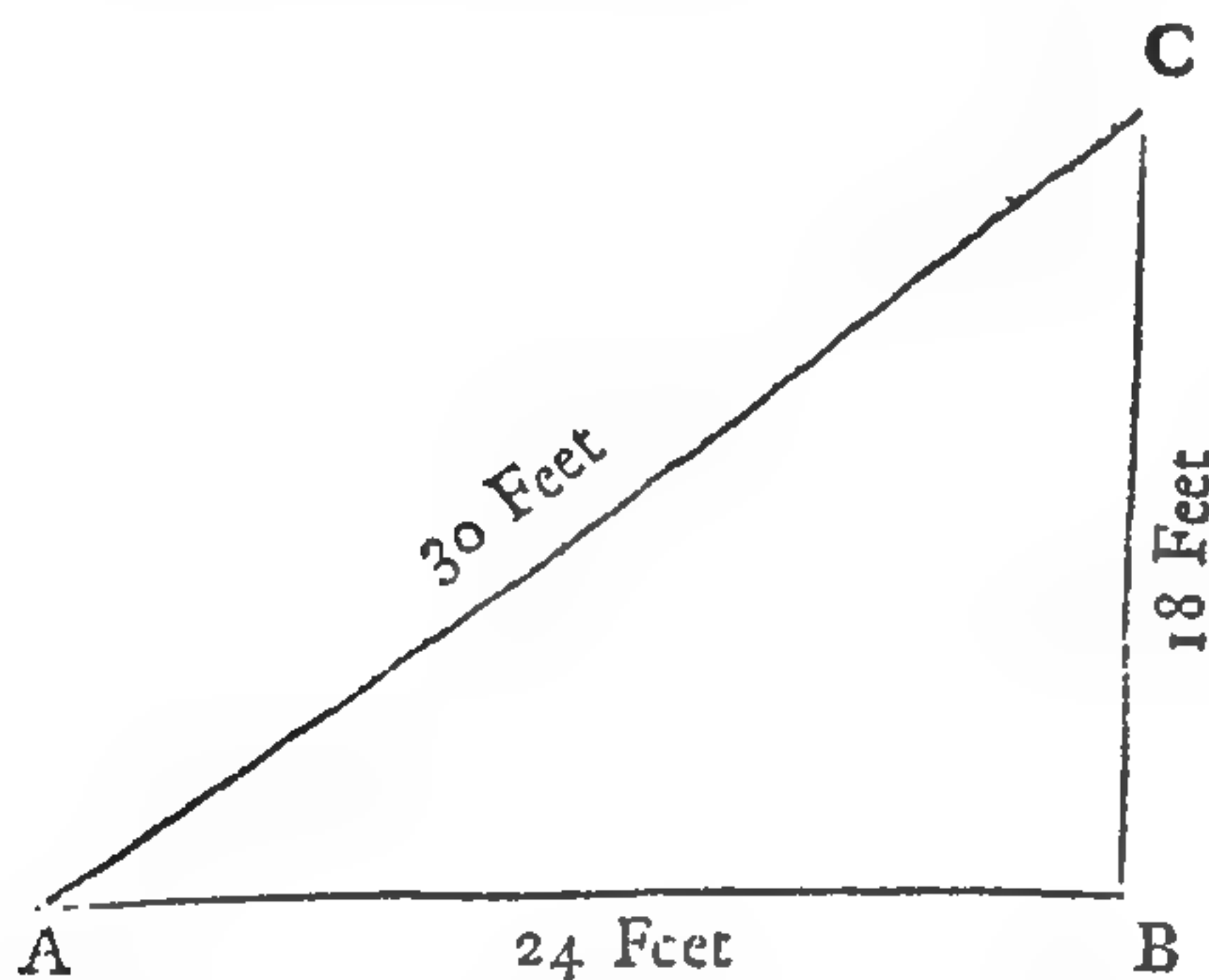
1. If I will find a mean Proportional between two given Numbers, I multiply the given Numbers, the

one by the other, and extract the *Square Root* of the Product, so shall that Square Root be the mean Proportional sought. For Example:

Let the given Number be 16 and 64, according to my Rule, I multiply 16 by 64, and the Product is 1024, the *Square Root* of which is 32, so that 32 is the mean Proportional between 16 and 64. Thus:

$$\begin{array}{r}
 16 \} \text{ multiply} \\
 64 \} \\
 \hline
 64 \\
 96 \\
 \hline
 1024 \text{ (32 Square Root)} \\
 9 \\
 \hline
 62) 124 \\
 124 \\
 \hline
 0 \\
 \hline
 \end{array}$$

Again, am I desired to find a third Side to two Sides of Right-angled plain Triangle given? For Example in the Triangle A, B, C, the Base A, B, is 24, and the Perpendicular B, C, is 18, now I am to find the Length of the Hypothenufe.



To answer this Proposition, I must first square the Base A. B. 24, which is 576, then square the Perpendicular 18, which makes 324; then add these two Sums together, and the Product is 900, and the Square Root of 900 is 30, which gives the Length of A. C. This Proportion is of great Use in measuring of Heights, Distances, and other mathematical Figures.

2. *As to solid Measures.*—If the Side of a Cube, be 12 Inches, how many Cubical Inches are contained in that Cube? To answer which I multiply the Length by the Breadth, and that Product by the Depth; as in this Example:

$$\begin{array}{r}
 12 \\
 12 \\
 \hline
 144 \text{ square Inches} \\
 12 \\
 \hline
 1728 \text{ cubical Inches} \\
 \hline
 \end{array}$$

In like Manner, if the Side of a Cube of Stone be 253 Feet, the solid Content of that Cube will be 16,194,277 Feet. Thus:

2

$$\begin{array}{r}
 2.53 \\
 2.53 \\
 \hline
 759 \\
 1265 \\
 506 \\
 \hline
 6.4009 \\
 2.53 \\
 \hline
 192027 \\
 320045 \\
 128018 \\
 \hline
 16.194277 \text{ Feet} \\
 \hline
 \end{array}$$

Note, That Solid in Geometry, is the 3d Species of Magnitude, having three Dimensions, Length, Breadth and Thickness.

To measure a Pyramid. A PYRAMID is a solid Figure, whose Base is a Polygon, and whose Sides are plain Triangles, their several Tops meeting together in one Point at the Top. Now if the superficial Content of the Base of a Pyramid be 5.756 Feet, and the Height thereof 14.25. (which said Height is the Length of the perpendicular Line, that falls from the Top of the Pyramid to the Base) what is the solid Content of that Pyramid? The Operation must be thus:

If the Area of the Base of the Pyramid be multiplied by $\frac{1}{3}$ of the Height thereof, the Product shall be the solid Content of the Pyramid, therefore $\frac{1}{3}$ of 14.25 is equal to 4.75, and 5.756, the Base be multiplied by 4.75 = 27.341 Feet, the Solidity of the Pyramid required.

$$\begin{array}{r}
 5.756 \\
 4.75 \\
 \hline
 28780 \\
 40292 \\
 23024 \\
 \hline
 27.34100 \text{ solid Feet} \\
 \hline
 \end{array}
 \qquad
 \begin{array}{r}
 3) 14.25 (4.75 \\
 12 \cdot \cdot \\
 \hline
 22 \\
 21 \\
 \hline
 15 \\
 15 \\
 \hline
 0 \\
 \hline
 \end{array}$$

To measure a Globe. A GLOBE, is a perfect round Body contained under one Plain; in the Middle of the Globe there is a Point, called the Center, from whence all strait Lines drawn to the Out-side, are of equal Length, and called Semi-diameters, the Double of any one of which, is equal to the Diameter of the Globe. Now if the Diameter of the Globe of Stone be 1.75 Feet, how many Feet solid are contained in that Globe? The Operation must be conducted by multiplying first the Diameter 1.75, by itself, the Product will be 3.0625, which multiplied again by the said 1.75, gives for the Product 5.359375, to wit the Cube of the Diameter; which being multiplied by .5238, the Product thence arising will be 2.807 +, which is the Solidity of the Globe propounded. Thus:

$$\begin{array}{r}
 1.75 \\
 1.75 \\
 \hline
 875 \\
 1225 \\
 175 \\
 \hline
 3.0625 \\
 1.75 \\
 \hline
 153125 \\
 214375 \\
 30625 \\
 \hline
 5.359375 \text{ Cube} \\
 5.238 \\
 \hline
 42875000 \\
 16078125 \\
 10718750 \\
 26796875 \\
 \hline
 2.8072406250 \text{ the Solidity of the Globe}
 \end{array}$$

Having already demonstrated and elucidated, all the Rules and Operations in *Arithmetick*, I'll conclude with what the *Arithmeticians* are pleased to call an *irrational*, or *incommensurable Number*, otherwise *Surd*.

SURD in *Arithmetick*, denotes a Number that cannot be expressed; or a Number that is incommensurate to Unity. When any Number or Quantity has its Root proposed to be extracted, and yet is not a true figurate Number of that Kind; that is, if its *Square Root* be demanded, and it is not a true Square; if its *Cube Root* be required, and itself be not a true Cube, &c. then it is impossible to assign, either in whole Numbers or in Fractions, any exact Root of such Number proposed. And whenever this happens, it is usual in *Arithmetick*, to mark the required Root of such Numbers or Quantities, by prefixing before it the proper Mark of Radicality, which is (as we have observed already) $\sqrt{}$: Thus $\sqrt{2}$ signifies the Square Root of 2, and $\sqrt[3]{16}$, or $\sqrt[3]{(3) 16}$, signifies the Cubick Root of 16; which Roots, because they cannot be expressed in Numbers exactly, (for no effable Number, either Integer or Fraction, multiplied into itself, can ever produce 2; or being multiplied cubically, can ever produce 16) are properly called *Surd Roots*.

There is also another Way of Notation now much in Use, whereby Roots are expressed without a radical Sign, by their Indexes: Thus, as x^2 , x^3 , x^5 , &c. signifies the Square, Cube, and fifth Power of x ; so $x^{\frac{1}{2}}$, $x^{\frac{1}{3}}$, $x^{\frac{1}{5}}$, signify the Square Root, Cube, &c. of x . The Reason of which is plain enough; for since \sqrt{x} is a geometrical mean Proportional, between 1 and x , so $\frac{1}{2}$ is an Arithmetical mean Proportional between 0 and 1; and therefore as 2 is the Index of the Square of x , $\frac{1}{2}$ will be the proper Index of its Square Root, &c.

We must observe also, that for Convenience or Brevity's Sake, Quantities or Numbers, which are not *Surds*, are often expressed in the Form of *Surd Roots*. Thus $\sqrt{4}$, $\sqrt[3]{8}$, $\sqrt[3]{27}$, &c. signify 2, $\frac{2}{3}$, 3, &c.

But though these *Surd Roots* (when truly such) are inexpressible in Numbers, they are yet capable of arithmetical Operations, (such as Addition, Subtraction, Multiplication and Division, &c.)

Surds are either *Simple* or *Compound*.

Simple Surds are those which are expressed by one single Term, as \sqrt{c} .

Compound Surds are those formed by the Addition or Subtraction of *Simple Surds*: as $\sqrt{5} + \sqrt{2}$: $\sqrt{5} - \sqrt{2}$, or $\sqrt[3]{7} + \sqrt{2}$: which last is called an universal Root, and signifies the Cubick Root of that Number, which is the Result of adding 7 to the Square Root of 2.

To Reduce rational Quantities to the Form of any *urd Root* assigned. For Example, if 3 were to be brought to the Form of $\sqrt[4]{}$: 12, you must raise 3 up to its fourth Power, and then prefixing the Note of Radicality to it, it will $\sqrt[4]{81}$, or $81^{\frac{1}{4}}$, which is the same Form with $\sqrt[4]{12}$. And this Way may a simple *Surd Fraction*, whose radical Sign refers only to one of its Terms, be changed into another, which shall respect both Numerator and Denominator. Thus $\frac{\sqrt{2}}{25}$ is reduced to $\sqrt[25]{2}$ and $\frac{5}{3}$ to $\sqrt[3]{125}$; where the radical Sign affects both Numerator and Denominator.

To reduce *Surds* to the lowest Term possible. Divide the *Surd* by the greatest Square, Cube, Biquadrate, &c. or any other higher Power, which you can discover, is contained in it, and will measure it without any Remainder; and then prefix the Root of that Power before the Quotient, or *Surd*, so divided; this will produce a new *Surd* of the same Value with the former but in more simple Terms.

This Reduction is of great Use, whenever it can be performed; but if no such Square, Cube, Biquadrate, &c. can be found for a Divisor, find out all the Divisors of the Powers of the *Surd* proposed; and then see if any of them be a Square, Cube, &c. or such a Power as the radical Sign denotes; and if any such can be found, let that be used in the same Manner as above, to free the *surd Quantity* in Part from the radical Sign. Thus if $\sqrt{288}$ be proposed; amongst its Divisors will be found the Squares, 4, 9, 16, 36, and 144; by which, if 288 be divided, there will arise the Quotients 72, 32, 18, 8, and 2; wherefore instead of $\sqrt{288}$, you may put $2\sqrt{72}$, or $3\sqrt{32}$, or $4\sqrt{18}$, or $6\sqrt{8}$, or lastly; $12\sqrt{2}$, and the same may be done in *Species*.

We have very little Intelligence about the Origin and Invention of *Arithmetick*; History neither fixes the Author, nor the Time. In all Probability however, it must have taken its Rise from the Introduction of Commerce, and consequently be of *Tyrian* Invention.

From *Asia* it passed into *Egypt*, (*Josephus* says by means of *Abraham*) here it was greatly cultivated and improv'd; insomuch that a large Part of their Philosophy and Theology, seems to have turned altogether upon Numbers, hence those Wonders related by them about Unity, Trinity; the Numbers seven, ten, four, &c. In Effect, *Kircher* in his *Aedip. Aegypt. Tom. II. p. 2.* shews that the *Egyptians* explained every Thing by Numbers; *Pythagoras* himself affirming that the Nature of Numbers goes through the whole Universe; and that the Knowledge of Numbers is the Knowledge of the Deity.

From *Egypt*, *Arithmetick* was transmitted to the *Greeks*, who handed it forward, with great Improvements, which it had received by the Computation of their Astronomers, to the *Romans*; from whom it came to us.

The ancient *Arithmetick* however, fell far short of that of the Moderns; most of what they did was to consider the various Divisions of Numbers; as appears from the Treatises of *Nicomachus*, wrote in the third Century of *Rome*, and that of *Boethius* still extant. A Compendium of the ancient *Arithmetick*, wrote in *Greek*, by *Piellus*, in the ninth Century from our Saviour, was given us in *Latin* by *Xylander*, in 1558. A more ample Work of the same Kind was wrote by *Jordanus*, in the Year 1200; published with a Comment by *Father Stapuleris*, in 1480.

Arithmetick, under its present State, is divided into different Kinds; viz. Theoretical, Practical, Instrumental, Logarithmical, Numerous, Specious, Decimal, Dynamical, Tetractical, Duodecimal, Sexagesimal, &c.

Euclid furnishes a *Theoretical Arithmetick*, in the seventh, eighth, and ninth Books of his Elements (which *Theoretical Arithmetick* is the Science of the Properties, Relations, &c. of Numbers considered abstractedly;

abstractedly; with the Reasons and Demonstrations of the several Rules.) *Barlaamus Monachus* has also given a Theory for demonstrating the common Operations, both in *Integers* and broken Numbers, in his *Logistica*, published in *Latin* by *J. Chambers* an *Englisbman*, in 1600. To which may be added *Lucas de Burgo*, who in an *Italian* Treatise, published in 1523, gives the several Divisions of Numbers from *Nichomachus*, and their Properties from *Euclid*; with the Algorithm, both in *Integers*, *Fractions*, *Extractions of Roots*, &c.

The first entire Body of *Practical Arithmetick* (which is the Art of numbering or computing from certain Numbers given, or finding certain others, whose Relation to the former is known, as if a Number be required equal to two given Numbers 6 and 8) was given by *Nich. Tartaglia* a *Venetian*, in 1556, consisting of two Books; the former, the Application of *Arithmetick* to civil Uses; the latter, the Grounds of *Algebra*. Something had been done before by *Stifelius*, in 1544; where we have several Particulars concerning the Application of *Irrationals*, *Cossicks*, &c. no where else to be met withal. There is almost an infinite Number of practical Authors, who have appeared since; as *Gemma Frisius*, *Metius*, *Clavius*, *Ramus*, *Buckley*, *Diggs*, *Record*, *Wingate*, *Cocker*, *Leyburn*, &c.

The Theory of *Arithmetick* is joined with the Practice, and even improved in several Parts by *Maurolicus*, in his *Opuscula Mathematica*, 1575; *Henescbius* in his *Arithmetica Perfecta*, 1609, where the Demonstrations are all reduced into the Form of *Syllogisms*; and *Tacquet* in his *Theoria & Praxis Arithmetices*, 1704.

Instrumental Arithmetick is that where the common Rules are performed by Means of Instruments contrived for Ease and Dispatch; are several Scales and sliding Rules; such more particularly are *Neper's Bones*, an Instrument whereby Multiplication and Division of large Numbers are facilitated and expedited; and so called from its Inventor *John Neper*, Baron of *Marchiston* in *Scotland*.

This Instrument is made of five Rods, Plates, or *Lamellæ*, of Wood, Metal, Horn, Past-board, or other Matter of an oblong Form, and divided each into nine little Squares; each of which is resolved into two Triangles by Diagonals. In these little Squares are wrote the Number of the Multiplication Table; in such Manner as that the Units, or Right-hand Figures, are found in the Right-hand Triangle; and the Tens, or the Left-hand Figures, in the Left-hand Triangle.

Use of Neper's Bones in Multiplication. To multiply any given Number by another; dispose the *Lamellæ* in such Manner, as that the Top Figures may exhibit the Multiplicand; and to these on the Left-hand, join the *Lamellæ* of Units; in which seek the Right hand Figure of the Multiplier; and the Numbers corresponding thereto, in the Squares of the other *Lamellæ*, write out, by adding the several Numbers occurring in the same Rhomb together, and their Sums. After the same Manner write out the Numbers corresponding to the other Figures of the Multiplier, let them be disposed under one another, as in the common Multiplication: And lastly, add the several Numbers into one Sum. For Example:

Suppose the Multiplicand 5978, and the Multiplier 937, from the outermost Triangle on the Right-hand, which correspond to the Right-hand Figure of the Multiplier 7, write out the Figure 6, placing it under. In the next Rhomb towards the Left, add 9 and 5; their Sum being 14, write the Right-hand Figure, viz. 4 against 6; carrying the Left-hand Figure 1, to 4 and 3, which are found in the next Rhomb. The Sum 8 join to 46 already put down; after the same Manner in the last Rhomb, add 6 and 5, the latter Figure of the Sum 11, put down as before, and carry 1 to the 3 found in the

Left-hand Triangle; the Sum 4 join as before on the left of 1846: Thus will you have the Factum of 7 into 5978; and after the same Manner will you have the Factum of the Multiplier, into the other Figures of the Multiplier: The Whole added together, gives the whole Product.

$$\begin{array}{r} 5978 \\ 937 \\ \hline 41846 \\ 17934 \\ 53802 \\ \hline 5601386 \end{array}$$

Use of Neper's Bones in Division. Dispose the *Lamellæ* so, as that the uppermost Figures may exhibit the Divisor; to these on the Left-hand join the *Lamellæ* of Units. Descend under the Divisor, till you meet those Figures of the Dividend, wherein it is first required, how oft the Divisor is found, or at least the next less Number, which is to be subtracted from the Dividend; the Number corresponding to this, in the Place of Units, write down for a Quotient. By determining the other Parts of the Quotient after the same Manner, the Division will be completed. For Example:

Suppose the Dividend 5601386, and the Divisor 5978; since it is first asked how oft 5978 is found in 56013, descend under the Divisor, till in the lowest Series you find the Number 53802 approaching nearest to 56013; the former whereof is to be subtracted out of the latter, and the Figure 9 corresponding thereto in the *Lamellæ* of Units, write down for the Quotient. To the Remainder 22118, join the following Figure of the Divisor 8; and the Number 17934 being found, as before, to be the next less Number thereto, the corresponding Number in the *Lamellæ* of Units, 3, is to be wrote down for the Quotient; and the Subtraction to be continued as before. After the same Manner the third and last Figure of the Quotient will be found to be 7; and the whole 937.

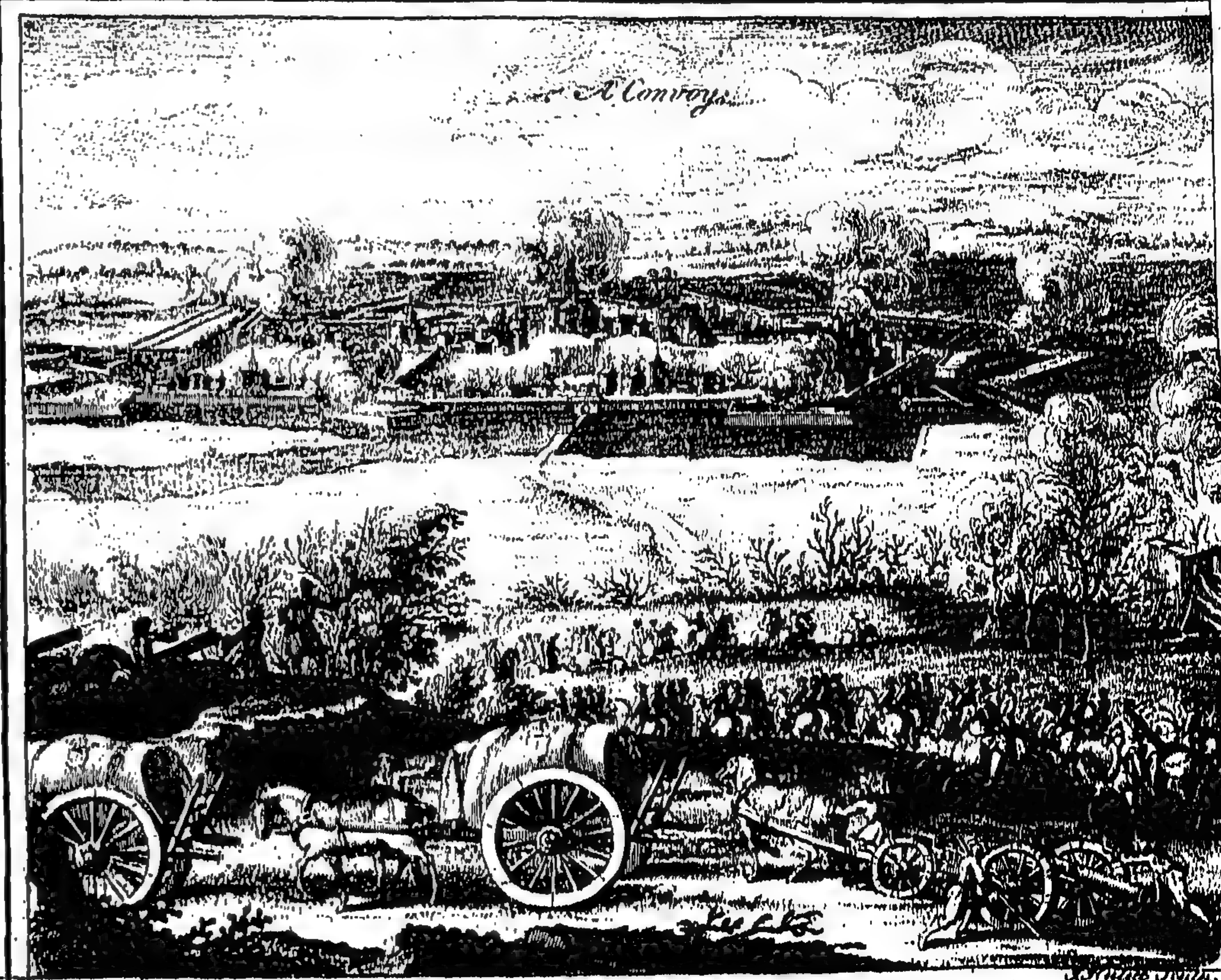
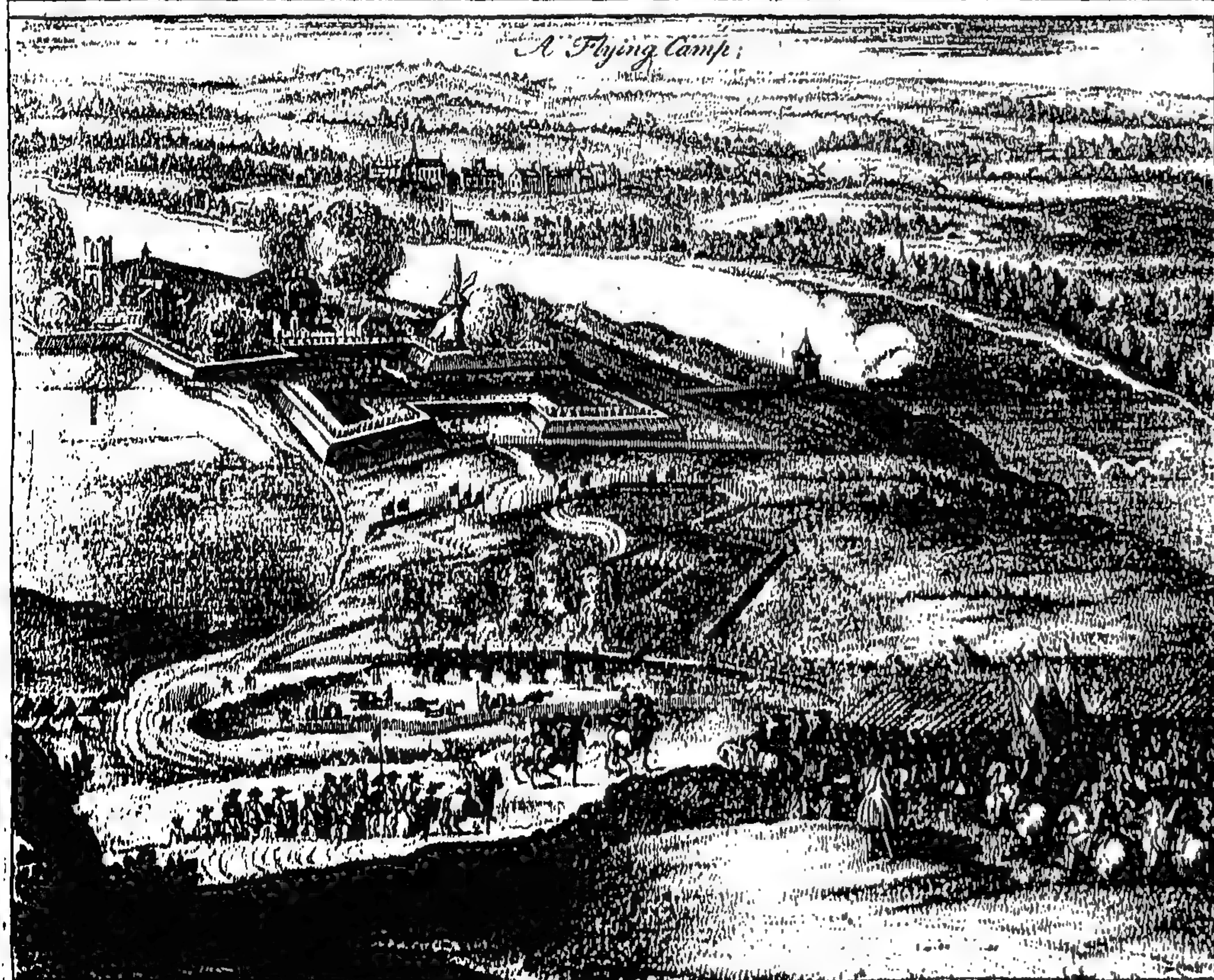
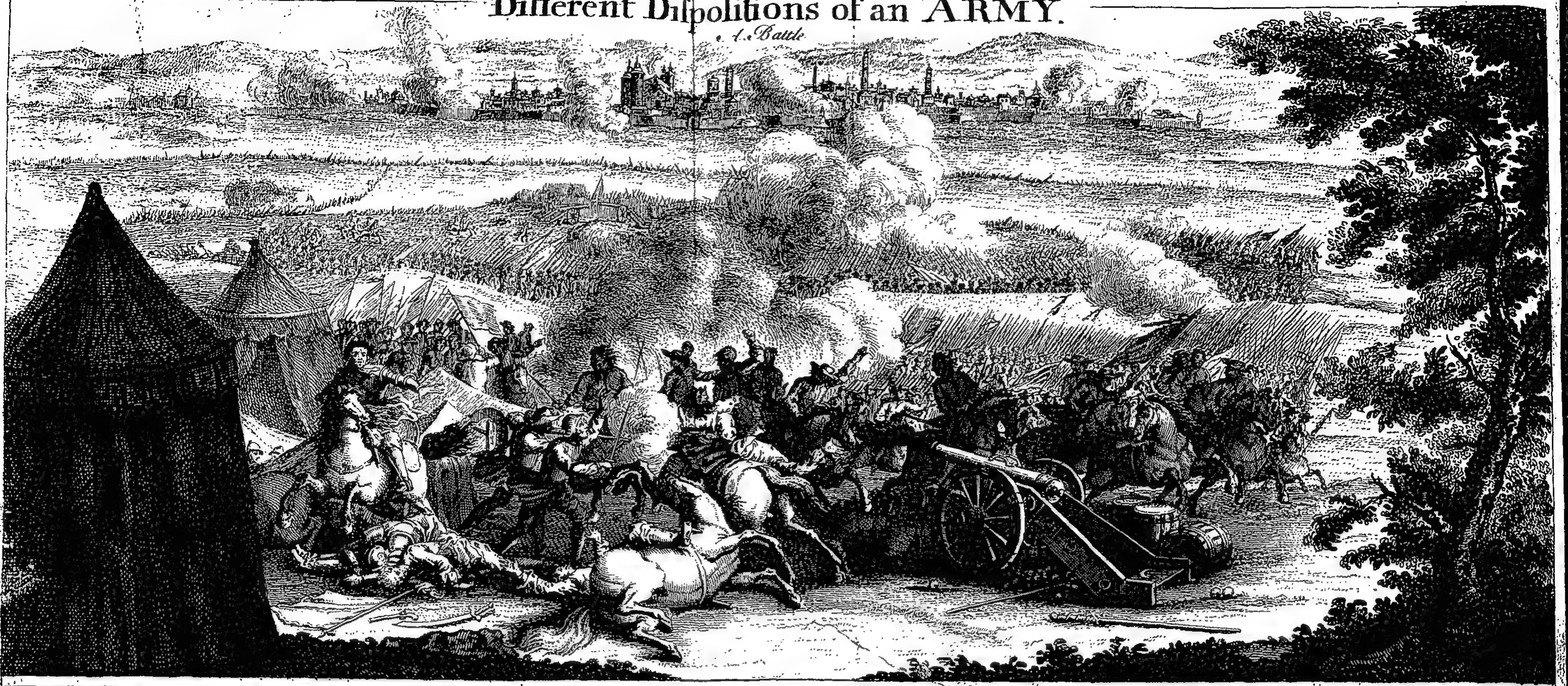
$$\begin{array}{r} 5978)5601386(937 \\ 53802 \\ \hline 22118 \\ 17934 \\ \hline 41846 \\ 41846 \\ \hline 00000 \end{array}$$

To *Neper's Bones* may be added *Sir Sam. Moreland's* Instrument, the Description whereof was published by himself in 1666; that of *Mr. Leibnitz*, described in the *Miscellan. Berolin*; that of *Polenus*, published in the *Venetian Miscellany*, 1709; the *Arithmetica Logarithmica* of *Hen. Briggs*, published 1624; and the *Universal Arithmetical Tables of Prothaphereses*, published 1610; by *Herwart ab Hohenburg*; whereby Multiplication is easily and accurately performed by Addition, and Division by Subtraction.

The *Chinese* have little Regard to our Rules in their Calculations; instead of which, they use an Instrument made of a little Plate, a Foot and Half long, a-cross which are fitted ten or twelve Iron Wires, on which are strong little round Bales. By drawing these together, and dispersing them again one after another, they count somewhat after the Manner in which we do by Counters; but with so much Ease and Readiness, that they will keep Pace with a Man reading a Book of Accounts, let him make what Expedition he can: And at the End the Operation is found done; and they have their Way of proving it.

The

Different Dispositions of an ARMY.



The *Decimal Arithmetick* is not of a very antient Date; since it was first introduced into *Europe*, by *Gerbert*, afterwards Pope, under the Name of *Silvester II*, who borrowed it from the *Moors* of *Spain*. No Doubt it took its Origin from the ten Fingers of the Hands, which were made Use of in Computation before *Arithmetick* was brought into an Art. The

Eastern Missionaries assure us, that to this Day the *Indians* are very expert at computing on their Fingers, without any use of Pen and Ink. Add, that the Natives of *Pera*, who do all by the different Arrangement of Grains of Maize, out-do any *European*, both for Sureness and Dispatch, with all his Rules.

A R M Y.

A R M Y, is a large Body of Soldiers under the Command of a General, with several Ranks of subordinate Officers under him.

Under this general Term *Army*, are commonly understood both a Land and a Naval, or Sea *Army*.

A *Land Army* is a large Body of Soldiers consisting of Horse and Foot; and a *Naval Army* is a Number of Ships of War, equipped and manned with Sailors and Marines, under the Command of an Admiral, with other inferior Officers under him.

Note, That under this Title *Army*, I design to treat of all the different military Expeditions, both on Sea and Land, viz. of the forming an *Army*, of Marches, Counter-marches, Camps, Battles, Retreats, Sieges, Defiles, &c. and of the Equipment of a Fleet, of a whole Fleet, of a Squadron, of Convoys, Sea-fights, &c. Beginning by the forming of a *Land Army*.

A *Land Army* is composed, as I have already observed, of both Horse and Foot, the Horse being called *Cavalry*, and the Foot *Infantry*.

The *CAVALRY* (from the *French Cavalerie*, and from the corrupt *Latin*, *Caballus*, Horse) is a Body of Soldiers, who fight or march on Horse-back. The *Cavalry* is usually divided into *Horse* and *Dragoons*. The Horse are either regimental or independent Troops, to which latter Sort belong the Horse-guards, and in *France*, the great *Gendarmes*, properly called the *Gendarmerie*, the *Mousquetaires*, the *Chevaux Legers*, and *Horse Grenadiers*.

The *Horse-Guards*, by the *Spaniards* called *Guardas a Cavallo*, by the *French*, *Gardes de Corps*, or *du Corps*, and by the *English*, usually *Life-Guards*; are the Guards of the King's Person and Body, consisting among us of 800 Men well armed and equipped. They are divided into four Troops; to which are now added, by Establishment, two Troops of *Grenadiers*, consisting of 80 Men, all under the Command of a Captain.

Each Troop of *Horse-guards* is divided into four Divisions or Squadrons; two of which consisting of 100 Men, commanded by a principal commission'd Officer, two Brigadiers and two Sub brigadiers, with two Trumpets, mount the Guard one Day in six, and are relieved in their Turns.

Their Duty is by Parties from the Guard, to attend the King's Person, when he goes out near home.—When he goes out of Town, he is attended by Detachments out of all the three Troops.

One of the three Captains of the *Horse guards* attend on the King when he walks on Foot, immediately next his Person; carrying in his Hand an Ebony Staff, or Truncheon with a Gold Head.

One Division of the *Grenadiers* mounts with a Division of the Troop to which they belong; and go out on small Parties from the Guard, perform sentinel Duty on Foot, attend the King also on Foot, &c.

The *Gardes de Corps*, or *Life guards* in *France*, consist of four Companies of Horse. The first was antiently *Scotch*, and still retains the Name; though it now consists wholly of *Frenchmen*. Not only the Name, but they also retain the antient Phrase or Formula of answering when called upon, *I am here*.

The *Scotch Guard* was first established in *France* by *Charles VII*. who chose himself a *Guard* out of such *Scots* as were sent by the Earls of *Bucan*, *Douglas*, and other *Scotch* Lords, to drive out the *English*.

The *Grands Gens D'armes*, are also a Troop of Gentlemen, to the Number of about 250, who guard the King's Person. The King himself is their Captain, and one of the prime Peers the Captain Lieutenant. When the King marches with all his household Troops, the *Gens D'armes* close the March. Their Device is a Thunder-bolt falling from Heaven, with the Motto, *QUO JUBET IRATUS JUPITER*.

The *MUSQUETEERS* are also of the King of *France's* Horse-guards; there are two Troops of *Musqueteers*, distinguished into the gray and black *Musqueteers*, from the Colour of their Horses. These are young Gentlemen of Distinction, instructed at the King's Expence in all the Rules of the Military Art or Discipline.

These three Bodies of Cavalry of the King of *France's* Household, viz. the *Gardes du Corps*, the *Grand Gens D'armes* and the *Musqueteers*, are composed of none but of Persons of Distinction.

That Body of Horse called by the *French*, *Gendarmerie*, is also of the King's Household, and consists of sixteen Companies, viz. the *Scotch Gens D'armes*; the *English Gens D'armes*; the *Burgundy Gens D'armes*, and the *Flemish Gens D'armes*, which four Companies compose the King's *Gens D'armes*.

The other Companies take their Names from the Princes who command them, as Captains, viz. the *Queen's Gens D'armes*; the *Queen's Light-horse*; The *Dauphin's Gens D'armes*; the *Dauphin's Light-horse*; The *Duke of Burgundy's Gens D'armes*; the *Duke of Burgundy's Light-Horse*; The *Duke of Orleans's Gens D'armes*, &c. Each Troop at a Medium, consists of seventy-six *Gens D'armes* or *Light-horse*.

Light-Horse in *England* includes all the Horse, except those of the *Life-guard*.—The Denomination arose hence, that antiently they were lightly armed, in Comparison of the royal Guards, which were armed at all Points.

The regimental Cavalry is composed of what we call here Troopers, and in *France* Cavaliers.—The *French* chuse for their Cavaliers, not very tall and bulky Men, which they suppose too heavy, and to fatigue too much their Horses; but square shoulder'd Men, with a full Face; which they suppose to have a better Grace on Horse-back.

The best Qualities for a TROOPER is to be bold and resolute, strong and healthy, of a daring and sprightly Temper, ambitious of Honour, and fearful of nothing but Shame and Disgrace.—Men inured to all Sorts of Fatigues, are to be preferred before those who are brought up in Ease and Softness, and their Age ought not to exceed thirty five Years, except they have been bred up in the Army, nor to be under eighteen.—They should be eager to improve that they may be advanced, and willing to obey.—They should be well mounted upon young, strong and sound Horses; and armed with good Pistols, Carabines, and good broad-cutting Swords.

The Troopers are to be instructed in the Use of their Horse and Arms, to march orderly in their Ranks, and to execute such Orders as they receive: Their

Their Arms are to be kept clean and well fixed, and the least Defect rectified. The Troop, if raw and undisciplined, are to be exercised every other Day, that they may know how to use their Arms dextrously, and march orderly. Old Troopers are to be placed upon the Right and Left, and when they are drawn out, let them march gently, and file off by four and four, then continue the March, and let them file off by two and two; then double and march again by fours, and at last still marching to form the Squadron again, another Day they may be taught to march upon a Trot, and in close Order; and in that Manner to file off by four's and two's, and then again to form the Squadron all upon a Trot. Another Day they may be taught to wheel to the Right and to the Left, and about, with some Firings, to inure their Horses to stand Fire.

The Troopers are formed into *Troops*, each Troop consisting commonly of 50 private Troopers, besides a *Captain*, a *Lieutenant*, a *Cornet*, and a *Quarter-Master*.

A *CAPTAIN* should be endued with a great and generous Soul, preferring his Honour above all Things, Life not excepted. When he first appears at the Head of his *Troop*, he is to salute the Subalterns, and having produced his Commission, assure them of his Friendship; and then invite them to his Quarters. The like Assurance may afterwards be given to all the Troopers upon their good Behaviour, whose Horses and Accoutrements he is to view carefully. He should consult with the Lieutenant, and Quarter-master, about filling up the Vacancies in his Troops, in remounting such as want Horses, and doing whatever else is necessary. He must know all the Troopers by their Names, that he may call any of them to give them his Orders. He is not to be guilty of Extortion upon any Account; neither is he to detain in his Hands the Troopers Pay, lest by such Practices he occasions them to desert or pilfer, which Crimes are not to go unpunished.

A *Captain* must chuse a Trumpeter who understands how to sound well, and particularly one who has been trained up in the War, and in whom he can confide. A Man thus qualified, when sent to the Enemies Camp, or any of their Garrisons, may give an Account how the Enemy is posted, the Nature of their Entrenchments, Ditches, Out-works, and of their Guards and the Avenues to their Camp.

A *Captain* ought to keep a competent Number of good Horses, and be curious in his Fire-arms, both for himself and Servant, and take Care that they be kept in good Order.

The *LIEUTENANT* of a *Troop*, ought to be a Person trained up in the Cavalry, and well experienced in that Part of the *Military Art*. He is to have a personal Knowledge of every Trooper; and, on Occasion, to call him readily by his Name. He is to observe diligently the Condition of every Trooper's Horse and Arms, and reprimand those who neglect either: And when they are upon a March, his Post is in the Rear of the Troop, if single, in Order to take Care that no Man quits his Rank, but follow his file Leaders. When they engage the Enemy as by Squadron, his Post is on the Right or Left, according to the Seniority of his Commission. When the Captain is commanded upon the grand Guard, or any other Guard, as soon as he comes to his Post, the *Lieutenant* having drawn up the *Troop*, shall continue at the Head of it on Horse-back, while the *Captain* receives Orders, and goes with the *Quarter-Master* to place the Vedettes, or Out-posts, on Horse-back, and to view their Posts, and instruct them how they are to behave themselves, till the *Captain* returns to give the other necessary Orders for his Guard.

The Duty of a *CORNET* consists principally in carrying the Standard upon a Review, or other publick Appearance, or to bear it in the Day of Battle, and in an Engagement to defend it; to salute the Prince, and in his Absence the General, and his Post is in

the Centre of the *Squadron*, about half a Horse's Length behind the Field Officer.

A *QUARTER-MASTER*, ought to be a Man of good Parts, Activity and Experience, since the Economy of the Subsistence, and Service of the Troops, depends upon him. — He should understand Writing and Arithmetick, whereby he may be qualified to keep the Accounts of the Troop, and to account with them for their Pay, or for any Share of Booty taken from the Enemy. — He is to receive Orders and the Word, which he should commit to Writing, and then carry them to his Officers.

He ought to view often the Troopers Horses, and take Care that they be well fed, dressed, shod, and accoutred, and to see that their Arms be clean, and to have such refitted as are out of Order. — Upon a March he is to receive Orders from the Captain, to go before and provide Quarters for the whole Troop, and for better Dispatch may, with the Captain's Leave, take one or two Troopers with him. — He is to shew his Orders to the Magistrate, and acquaint him with the Captain and other Officers of his Regiment, and to view their Quarters, that they may have no Cause to complain. — The Quarters being timely provided, he shall mount and meet the Troop as it draws near; and if the Billets be delivered to him, he is to conduct the *Captain* and the *Troop* to his Quarters; but if the Magistrate will see the Effective Men before he delivers the Billets, then he shall lead the *Captain* and the *Troop* to the Town-Hall, or some other publick Place, and having received the Billets, shall wait on the *Captain* to his Quarters, and drawing up the Troop in one single Rank, cause the Billets to be drawn out of his Hat, and admonish the Troopers to be civil to their Landlords. — He is to keep an exact List of the Quarters, that he may visit their Horses; and if any of them have received any Damage, he is to take Care to have them speedily cured.

When the Trumpet sounds to Horse, he is to mount first and hasten the Troopers, and repair to the *Captain's* Quarters. — Upon a March, his Post is upon the Flank of the *Troop* or Squadron, and he is to ride from the Front to the Rear, and from the Rear to the Front, to view the Ranks, and make them keep their due Distance. — In Time of Action he is to be upon the Flank, with his Sword drawn, to prevent the Men falling into Disorder, and to kill the first who shall offer to fly.

Troops are form'd into Squadrons; three Troops to each Squadron: And those Squadrons into Regiments; three Squadrons to each Regiment, which commonly consists of 300 Men: Though there are some in *Germany* of 2000 Men.

Among us a Regiment of Horse is commanded by a Colonel, and in *France* by a *Mestre de Camp*.

There are *Colonels*, *Colonel-Lieutenants*, and *Lieutenant-Colonels*. — A *Colonel* is an Officer who has the Command in chief of the Regiment. — A *Colonel-Lieutenant*, is he who commands a Regiment of Guards, whereof the King, Prince, or other Person of the first Eminence is Colonel. — And a *Lieutenant-Colonel*, is the second Officer in a Regiment; who is at the Head of the Captains, and commands in the Absence of the *Colonel*. — In the Horse, the *Lieutenant-Colonel* is the first Captain of the Regiment.

The *DRAGOONS* are also ranked in the Cavalry. The Dragoons are a Body of Soldiers who march on Horse-back, and fight on Foot; though most commonly on Horse-back.

The *Dragoons* are usually posted in the Front of the Camp, and march first to the Charge, like a kind of *Enfans perdus*. They are by some reputed as belonging to the Infantry, and in that Quality have Colonels and Sergeants; but they have Cornets too, like Cavalry. — In *France*, to inspire the Dragoons with Valour, they are allowed a Pair of Kettle-drums, when they have gained it from the Enemy, else they have only Drums. The *French* Dragoons have Boots without

without Shoes, which they call *Botines*; and which, when dismounted, cannot hinder them from fighting on Foot. Their Arms are a Sword, Firelock, and Bayonet. In the *French* Service, where the *Dragoons* march on Foot, the Officers bear the Pike, and the Serjeants the Halbert; neither of which are used in the *English* Service.

The *Cuirassiers* belong also to the Cavalry, so called from wearing a *Cuirass*, which is a Piece of defensive Armour, made of an Iron Plate well hammered; serving to cover the Body from the Neck to the Girdle, both before and behind. The *Cuirass* was not brought in Use till about 1300. Good Part of the *German* Cavalry are *Cuirassiers*.

The *Ottoman* Cavalry are called *SPAHIS*, chiefly raised in *Asia*, and the Aga or Commander of the *Spahis*, *Spahi Agasi*.

The most considerable Part of an Army consists in the Foot, or *INFANTRY*, divided also into Companies, Battalions and Regiments.

A *COMPANY* is a little Body of Infantry, commanded by a Captain. The Number of Men in a Company is uncertain; in the ordinary Regiments it is fifty Centinels, besides three Serjeants, three Corporals, 2 Drums, &c. A Company in the Guards is eighty Private Men. In the *French* Guards, the Company is 120, in the *Swiss* Guards 200. Companies not imbodyed into Regiments are called *Independent Companies*.

The Officers of a *Company of Infantry* are a Captain, a Lieutenant, an Ensign, and a Serjeant.

A *CAPTAIN of Infantry* must understand perfectly the Duties of a *Lieutenant*, *Ensign*, and *Serjeant*, and when a Vacancy happens, he should give the Halbert to him that deserves it best, allowing to the eldest *Corporal* somewhat more than his bare Pay, lest he debauches the whole Company. A *Captain* should understand *Arithmetick* as far as the *Square Root*; and if he knows not how to take the Dimensions of inaccessible Bodies, he must at least know the Lines of Defence, and how to gain a flank'd Angle, to carry up a Trench to it, to make a good Lodgement upon it, and to flank it well; to order his Place of Arms and Batteries conveniently; to begin the Sap at the Foot of the *Glacis*, on the Edge of the Ditch; to make a Descent into a Place that is easy to be defended; to carry a Gallery across a Ditch, after he has made a good Lodgement to support it, well empaled and flank'd; so that the Enemy may not attack it without Danger; and in fine to know how to lodge himself on a Breach; for though there are Engineers who are to order these Things, yet they are generally tedious, and many Eyes can see more than two. Besides as a *Captain* is sometimes obliged to do the Duty of a *Major*, or *Major of Brigade*, he must therefore be laborious and vigilant, and understand their Duties, Rights, Privileges and Prerogatives. Moreover he is to know all the other Duties of those Posts to Perfection, and the Articles of War; how Cases have been decided upon Controversies formerly started; the Posts of all Regiments, and what is due to his own. These are the most essential Duties of a *Captain*.

A *LIEUTENANT of Infantry* ought to know the Duty of a Soldier to Perfection, and allowing him to have the Qualifications of an *Ensign*, he is farther to know how to discourse pertinently of the Methods of War; as how to gain an Advantage in all Places and Exigencies; of making a good Encampment; of intrenching in all Sorts of Places; of cantoning without Noise or Confusion, because he commands the Company in the Absence of the *Captain*. He is to know all the Articles of War, and all that concern the Right, Honour, and Duty of his Post, to prevent Mistakes and Contests, which often retard the Service; and that he may give his Opinion upon due Information, in Councils of War, to which he may be called for want of *Captains*. He must know all the Soldiers of the Company and hold Intelligence with some of them, take Care that they keep their Arms clean, to

send the Sick to the Hospital, and that they be diligently attended.

An *ENSIGN* should be perfect in all the Duties of a Soldier, and understand *Arithmetick* as far as the Extraction of the Square Root, because it is the *Basis* of the Military Art. He should be expert in handling his Arms, that he may judge whether the Soldiers do it gracefully; and he should teach and cause them to be taught before him. He is not to be ignorant of any Thing that belongs to the Rank, Honours, Privileges, Service, and Post due to his Employ. He is to keep a List of all the Men in the Company, and to know them so well as to call them readily by their Names. He is not to miss a Siege, or fail to go into the Trenches. He is to listen to old Officers, and wait upon the *General* with his *Captain*, to study Fortification, and Geography, and be conversant in History.

A *SERGEANT* should be perfect in the Exercise of the Fire-lock, and the usual Evolutions, that he may instruct raw and ignorant Soldiers, and make them honour and respect him; and he is to see that the Word of Command, when given to the Battalion, be punctually obeyed. He must understand how to make a good Lodgment and Epaulement, and to carry on a Sap as directed; and he must never disguise the Truth, and especially when sent to view or measure any Thing; and on him often depends the Honour of the Regiment; for it is usual to detach a Serjeant with a small Number of Men, to fall on before a greater Detachment, that is to follow; to advance a Lodgement, gain a Traverse, or Barricade, or to begin an Attack of any Kind whatever: If he performs not his Duty, either through Cowardice or Ignorance, every Thing is presently in Disorder; and if this happens in the Trenches, it may retard the taking a Place a Day, and then if it should be relieved that Day, the whole Fault will be laid upon the Regiment then in the Trenches; and it will be long before it can wipe off a notable Blemish; and it were much better a Company had no *Serjeant*, than to have such as do not understand those great and essential Parts already mentioned.

A *Serjeant* is to be diligent and assiduous in his Duty, either upon a March, or in Garrison, and see all his Soldiers quartered before he quarters himself; He must never fail to receive Orders, and carry them to his Officers; and agree with his Brother *Serjeants*. He is to chuse a favourite Soldier in whom he can confide, and adjust all Differences that shall arise in the Company; and to compel them to mend their Cloaths and Shoes, and oblige them to keep their Arms in good Order. He must keep Intelligence with the most tried Men, to discover whether any of the others design to desert. He ought not to be fond of his own Opinion, but to ask Advice of the *Major*, or some other experienced Officer.

The *COMPANIES* of Infantry are formed into Battalions.

A *BATTALION*, is a little Body of *Infantry*, rang'd in Form of Battle, and ready to engage. A *Battalion* usually contains from 5 to 800 Men, of which one Third were formerly Pikes in the Middle, and the other two Thirds Muskets, posted on the Wings: But the Number of Men it consists of is not determined. *Battalions* are usually drawn up with six Men in a File, or one before another.

A *REGIMENT* usually consists of several *Battalions*, though some consist but of one, which is too few, others of four, or five, which are too many. The *French* Regiments consist commonly of three *Battalions*, or fifteen *Companies*. Though the *Regiment of Picardy* consists of 120 Companies or 6000 Men.

A *Regiment* is commanded by a *Colonel*, a *Lieutenant-Colonel* and a *Major*.

The *COLONEL* of a *Regiment of Infantry* should be a Man of Credit and Authority, grave in his Behaviour, lofty in his Deportment, yet without Vanity and Haughtiness; courteous to all Men, particularly,

larly to the Officers of his own Regiment. He must extol Worth, though it be in a private Centinel; and is to make known to the General, or even to his Sovereign, any good or notable Action performed by any Man under his Command. If he has just Cause to speak ill of any Man, let him not do it in Publick, except he has reprov'd him twice in private. If any of his Officers are guilty of Cowardice or Mutiny, he is to acquaint the General, or Commander in Chief, in Order to have them brought to a general Court Martial. He must frequently view and examine all the Companies in his Regiment, commending those Captains who have good ones, and privately reprimanding those who have bad; and he is to be frequently present, when the Regiment performs their Exercise, and to encourage such who do better than the rest.

The Duty of a **LIEUTENANT COLONEL** is much the same with that of a *Colonel*.—In the Absence of the *Colonel* he is to command the Regiment, and then the Major is to receive Orders from him.

A **MAJOR** of a Regiment of *Infantry* should have a profound Experience in War, especially in the Foot Service.—He is to understand how to attack a Place; and when the Regiment marches into the Field, he is to give Notice of the effective Strength of it, and is to acquaint the General, or his Sovereign, if he discovers any evil Design among the Officers.—Besides the Knowledge of drawing up the Forces, forming Battalions, and exercising them, the *Major* of a Regiment is to see, that in marching they observe their Distances, that they carry their Arms well, that the Ranks be strait, and every Thing done with Decency, and a good Grace.—In the Field he should have two or three Horses, War-Horses, and Pads, because it is his Business to carry Orders, and to be every where upon Occasion.—The *Major* must also have an Adjutant, who ought to be well mounted, and be a Person of Experience, Ability, Courage, and Judgment, because he is the *Major's* Right-hand, to ease him of Part of the great Burden of his Employment, and upon all Occasions in his Absence, whether for Wounds, Sicknefs, or any other Occasion to perform all the Duty of a *Major*.—Care is to be taken that there be a good *Drum-Major* to the Regiment, who is to teach the others how to behave on all publick Occasions.

The Squadrons of Cavalry, and the Battalions of Infantry are formed into Brigades.

The **BRIGADE** of an *Army*, consists of ten or twelve Squadrons, or of five or six Battalions, and in this Manner, an *Army* is sometimes divided into eight *Brigades*; four of Horse and four of Foot. Each *Brigade* is commanded by an Officer called *Brigadier-General*, who has under him an Officer called *Brigadier-Major*, or *Major* of a *Brigade*, to assist him in the Management and ordering his *Brigades*, in which he acts as a *Major-General* does in an *Army*.

An **ARMY** is commanded by a General, who has under him Lieutenants-General, Majors-General, Brigadiers, &c.

A **GENERAL** is an Officer who commands all the military Power of a Nation; who gives Orders to all the other general Officers; and receives no Order himself but from the King.

Monsieur *Balzac* observes, that the Cardinal *de Richelieu* first coined this Word, of his own absolute Authority, upon his going to command the *French Army* in *Italy*.

At present in the *French Armies* a *General* is almost always a Marshal of *France*, which is the highest military Dignity or Preterment.—The Dignity of a Marshal is now for Life, though at its first Institution it was otherwise. They were then only the King's first Ecuysers under the Constable, but in time they became the Constable's Lieutenants in the Command of the *Army*, the Constable himself being then

become Captain-General. At first they were but two in Number, and their Allowance was but 500 Livres *per Annum* in Time of War, and nothing in Time of Peace. In the Reign of *Francis I.* their Number was increased to five, since him it has been various; the late King increased it at Pleasure, and made some very little deserving that high Dignity; it is now eleven. Their Office at first was to marshal the *Army*, under the Constable, and to command in his Absence. They did then what the *Marshals de Camp* do now, to which last they have given their Title, and the least considerable Part of their Authority.

A Prince can never be too cautious in the Choice of his *Generals*, since the Preservation or Loss of Kingdoms often depends upon the Conduct of those intrusted with the Command of *Armies*.

The principal Qualities requisite in a *General*, are Courage, Conduct, and Zeal; and if a natural Inclination to War attends these Qualities, there are scarce any Difficulties which may not be surmounted. Probity is another Quality necessary in a *General*; and it is this Virtue which informs a *General*, that he is not to employ the Forces his Prince intrusts him with, any otherwise than for the Good of his Country; and that he must not make Use of them to commit Rapine and Violence on the Subjects, nor even on the Enemies, except it be for his Prince's Advantage. Liberality gives a great Lustre to all the other Perfections of a *General*, since nothing is more scandalous for him, and more injurious to the Prince he has the Honour to serve, than to see him governed by that monstrous Vice *Avarice*, which eclipse at once the most excellent of all his Qualities, as his Courage, Skill, Experience, &c.

The Duties of a *General* are to order an Encampment, to post the Camp-Guard, to march an *Army*, to draw it up, to give Battle, to attack Enemies Quarters or Towns, to form a Blockade, and lay Siege to any Place. He must understand what Train of Artillery is requisite in Proportion to the Strength of his *Army*, and what he is capable of attempting; and also from whence he is to have his Provisions and Ammunitions, what Money will be allowed to pay his Men to defray the Charge of Works, for his Provisions, Artillery, and Hospitals, and for secret Services, upon which Matters of the greatest Importance frequently depend.

A **LIEUTENANT-GENERAL** is next in Rank to the *General*; he commands in Battle one of the Lines or Wings; a Detachment in a March, or a Flying Camp; also a Quarter at a Siege, or one of the Attacks, when it is his Day of Duty.

MAJOR GENERAL, is a general Officer, who receives the General's Orders, and delivers them out to the *Majors* of *Brigades*, with whom he concert what Troops are to mount the Guard, what to go on Parties, what to form Detachments, or to be sent on Convoys, &c.

There are other general Officers attending an *Army*, as *General* of the Artillery, *Engineer-General*, *Master-Master*, or *Commissary-General*, &c.

GENERAL OF ARTILLERY, more properly called *Master of the Artillery*, is an Officer, who has under his Command and Direction the Train of *Artillery*, which follows an *Army*, and all the Batteries at a Siege. He has under him a great Number of subaltern Officers.

The **ENGINEER-GENERAL**, is an Officer, who has the Direction of Attacks, Defences, Works, &c. An *Engineer* should be an able and expert Mathematician, particularly versed in Military Architecture, and Gunnery; being often sent to view and examine the Places intended to be attacked, to choose out and shew the *General* the weakest Place, to draw the Trenches, assign the Places of Arms, Galleries, Lodgements on the Counterscarp, and Half-moons; conduct the Works, Saps, Mines, &c. and appoint the Workmen their nightly Task: He is also to make the Lines of Contravallation with the Redoubts, &c.

MUSTER-MASTER, or *Commissary-General*, is an Officer in the Army who takes Account of every Regiment, their Number, Horses, Arms, &c.

Having thus formed an Army, both of Cavalry and Infantry, appointed and commissioned all the Officers both General and Private, instructed them in their several Duties; we must not keep it idle in its Quarters, since through Idleness, Effeminacy, Puff-lanimity, Debauchery, and all the other Vices capable to weaken an Army, and render it despicable, are introduced into it; for there is a great deal of Difference betwixt appearing at a Review, and facing the Enemy; betwixt firing in Platoons, or otherwise, with Powder only, and hearing that whistling Musick, which diverted so well *Charles XII.* King of Sweden, at his Landing in Denmark in 1700, that he declared then, he would thenceforwards make it one of his principal Diversions; therefore to inspire our Army with the same noble Desire, and to use it to the same Entertainment, we will order to beat the General, in order for an Encampment; since all the Courts of Europe seem inclinable at this Conjuncture, to have most of their Troops encamped: To order which, (as I have no Design that my Army should continue any Time in the Camp, for I am all for Action) I'll send the *Major-General* of the Day, to mark out the Camp; for if my Army was to continue long in it, it would be my Duty as a General to mark the Camp myself.—For the well ordering of this, I suppose my *Major-General* to know the Number and Post of the Troops which compose the Army, what Train of Artillery there is, and what Provisions.—He'll take with him the *Quarter-Master-General* of the Army, the *Quarter-Master-General* of the Horse, the *Quarter-Masters* of each Regiment of Horse, the *Majors* of Foot Regiments and their *Quarter-Masters*, a *Commissary* of the Artillery, and a *Commissary* of the Provisions.—The head Officers of the Army must each of them send one of their Guard, to take up their Quarters; and the *Provost-Marshal* or his *Lieutenant*, with Part of their Men, must attend the *Major-General*, to be the First upon the Quarters to prevent any Body from foraging.

Note, That the *Provost-Marshal* of an Army is an Officer appointed to seize and secure Deserters, and all other Criminals. The *Provost-Marshal* is to go often abroad round the Army to hinder the Soldiers from pillaging; it is his Office to indict Offenders, and to see the Sentence passed upon them executed. He likewise regulates the Weights and Measures, and the Price of all Provisions, &c. in the Army. For the Discharge of his Office, he has a *Lieutenant*, a Clerk, and a Troop of *Provosts*, or *Marshal-Men* on Horse-back; as also an Executioner.

The *Major-General* must take a Guard sufficient to conduct him safe to the Ground, on which he designs to encamp, and carry Horse and Foot enough with him, if he is apprehensive he shall meet with any Opposition from the Enemy; and if he is not, he then may leave the Army a League, or three Miles distant from the Place he designs for the Camp; but if he is, then he must not leave them above a Quarter of a League, or little more than a Mile behind him. If he is not acquainted with the Way, he must take Guides with him, and some Officers of the Train of Artillery, with Pioneers, and Cart-loads of Tools, to make the Way easy for the Army to march; and if there be much Work to be done, a Guard must be left to secure the Pioneers. He must detach a Party before him to go and view the Ground, and on the Right and Left to prevent Ambuscades, and to appoint them a Place of Rendezvous, which is generally on a rising Ground, the Way he comes to them, if he has not a particular Reason for not shewing himself. If the Detachments are not returned when he comes up to the Place of Rendezvous, he must halt there till he has Intelligence of

them, and send out Parties the Way they should come; and he must not take the Ground till he has heard of them, or at least till the Ground has been nicely viewed. He is to regard the Conveniency of Forage, of Springs, Brooks, Marshes, of Woods, the Goodness of the Way, the Conveniency of filing off to march the next Day, and the Distance of the Place from whence the Army sets out, that the March may not be too long or too short.

If the *Major-General* cannot be so fully informed as he could wish, to make a good Choice of the Ground to encamp on, he must send Persons which can make a judicious Report, and then he must send Part of his Guard beyond the Place of Encampment, who are to continue there upon Guard till they are relieved; and several Scouts shall be sent out to examine all the Parts about the Guard. If the *Major-General* has more Troops than are necessary for the Guard of the Quarters, he shall order them to dismount, and let their Horses graze. He shall leave a small Guard on that Side by which he came; and if from an Eminency he cannot discover all round the Quarters, he then shall ride over all the Ground, and in the mean Time the *Quarter-Master General* shall mark out the Ground, and divide it among the *Quarter-Masters*; and if there remains any after the General Officers have their Ground, it must be given to Officers of Regiments for their Baggage, they being obliged to encamp with their Corps; and the *Quarter-Master-General* is to make his Report to the *Major-General*, that he may lodge the General's Guard by his Quarters, and the others who are to be about him. He shall shew to the *Majors* of Brigades the Ground that is allotted to each of them, and the *Quarter-Master-General* of the Horse where he is to encamp. He shall also appoint the Place for the Cannon, and the Park for the Train and Provisions.

Note, That a *Quarter-Master-General* is a General Officer, whose Business is to provide good Quarters for a whole Army. A *Quarter-Master* of Horse, quarters for a Troop of Horse. And a *Quarter-Master* of Foot, for a Regiment of Foot.

He must encamp as near as possible to a River, or Brook; and if the Enemy is near and strong, the Troops shall encamp all on one Side. If the Enemy is beyond the River in respect to the Army's March, they must not pass over, until all the Passes are lined with Cannon, and Musqueteers, that the Army defiling in a short Time, may not be engaged by Piece-meal; neither must the Passage be attempted, except there be Day-light enough for all the Army to pass: But if there be any Cause to fear that the Enemy, taking the Advantage of the Night, may entrench themselves on the Bank of the River, and so render the Pass the more difficult the next Day, then the Troops are to pass as fast as they come up; and the Post they take ought to be deemed an advantageous Field of Battle, rather than a convenient Lodgment. If the Enemy be not far off, then the *Major-General* shall cause the Cannon to be posted on the Side next to them, if not, at the Head of the Road they are to march next Day.

The Park of the *Train of Artillery* is generally near the Cannon; but in Case of Danger the safest Place is about the Camp; because an Army may be routed by losing its Ammunition. The Horses of the *Artillery* are to encamp, or graze, near the Park. The Provisions are for the most Part near the *Artillery*, and the Bread Carts are drawn up in a Ring to inclose their Horses; but it is better to inclose the Ammunitions with them, if you fear the Enemy.

The *Cavalry* is to encamp the nearest to Water, and to Orchards, or Hedges, if there are any, that they may have Time to mount, and not be surprized in Case of an Alarm; and Ways should be cut a-cross them towards the General's Side, to receive Orders, and towards the open Plain, to march out to the

Field of Battle. The Camp of the Horse is covered with that of the Foot, leaving the Space of fifty Foot between them; but if the Foot are so weak that they cannot cover the Camp of the Horse, then they are to encamp on that Side that is most exposed to the Enemy. The Troops are to have their Back towards the Quarters, and to face outwards; and their File, or Rows of Huts, being three Paces from their Arms, which are always in the Front. The *Seijeants* have the front Hut, and the Officers encamp in the Rear.

In an Encampment for a Night, fifty Paces in Depth, of three Foot to a Pace, and four Paces in Breadth are allowed for every Company, for the Soldiers Huts; and if the Company exceed not seventy Men, Ground is to be allowed only for one Row, or File of Huts. The *Subalterns* are next behind the Huts, the *Captains* behind them, the Field Officers behind the *Captains*, and a convenient Interval for a large Street is left, clear between every two Regiments. But the Horse have fifty Paces in Depth for sixty Horse, and fourteen Paces in Breadth for three Rows of Huts; and if there are Hedges, they have as much Space allowed them as is requisite to tie their Horses. If the Enemy be stronger in Horse, and the *Major-General* apprehends that the Camp may be attacked, he must order Ditches and Trenches to be cut in their Way, to prevent their charging in good Order, to gain an Opportunity for the Foot to engage upon an Advantage; but if the Enemy be stronger in Foot, then the *Major-General* should encamp on the Edge of a Plain, that the Horse may draw up there, and the Enemy's Foot be afraid to engage where they can have no Advantage against the Horse.

A convenient Place must be chosen by the *Major-General*, to draw up the Army in Case of an Alarm, and there the Forces are to rendezvous: And besides the general Field of Battle, every Regiment must have its particular Ground to draw up on, from whence it must not march, 'till it has formed the Battalion, or Squadron; otherwise a small Number of the Enemy's Forces, having gained the Field of Battle, would defeat a great Army, should they be divided into small Bodies, and those ill-formed. It is dangerous to appoint but one Field of Battle for all the Forces, because, should all the Avenues to the Camp be left unguarded, the Enemy might give an Alarm in one Place to draw the Army thither, and then attack it in another. It would therefore be convenient to appoint the best Field of Battle for half the Army, and two or three others for the rest of the Forces, there to expect the *General's* Orders. If the Safety of the Troops only be regarded, it is best to have but one Field of Battle, but if we consider the Loss of the Baggage, something may be hazarded to save the whole. When there is Cause to fear such an Attempt, the best Way is to encamp in Battle, so that every Battalion and Squadron drawing up before their own Tents, will there be in Order; and if the Enemy is near, and has no Defile to pass, the Troops are to continue loose, and shall rest upon their Arms, being drawn up. If there be the least Danger to be apprehended, the eldest Regiment in the Army, the Artillery, the Provisions, and a great Part of the Foot, must encamp near the *General's* Quarters. Those Troops which are to have the Van next Day, must encamp on the most advanced Part of the Camp, on the Way they are to march, and so likewise if the Quarters are divided.

But when an Army is to encamp for any Time, the *General* for the most Part orders the Encampment. He is then to consider what Provisions are in or near the Place, and what Convenience of securing and bringing them to the Army; and if there be Corn how it may be made into Meal. If there be no Provisions, he must consider how to get them, and take Care that they be not cut off by the Enemy. The Convenience of Forage, Water, Shelter, Wood, and Wholesomeness of the Air, to prevent Diseases, are

also to be considered: If he must entrench, a convenient Ground must be sought out. In this Case the Manner of encamping shall be according to the Method of Entrenchment; and the Head of the Camp shall be at least a hundred Paces from it, without extending the Camp too far: And the Intrenchment is to be made as near as can be on the highest Ground all about the Camp, provided it be not at too great a Distance; and though it seems, when of the greatest Extent, to require the greatest Guard, yet fewer Men will maintain it, than when it is smaller, and the Enemy has the Advantage of the Ground.

The Ditch of the Entrenchment must be at least nine Feet over at the Top, and three or four at the Bottom, and six in the Depth: But Experience has taught us, that there may be more Hopes in fighting in an open Field, than behind a less Intrenchment than we represent, even though our Army be weaker than the Enemy: For the Soldiers placing most of their Hopes in the Strength of the Intrenchment, if one Part be forced they abandon the rest; and the Assailants, being persuaded that all the Difficulty consists in forcing the Intrenchment, think nothing can stand before them, and with this Confidence they increase their Courage.

However this Intrenchment is good, when the Ditch is 12 Foot wide at the Top, four at the Bottom, and eight in Depth; and when the Earth is thrown up out of it, makes a proportional *Parapet*, with a *Banquet* behind it for the Musketeers to stand on. At every eight Foot Distance there must be *Redans*, or indented Works; and it is observable that twenty Shots flanking do more Execution, than sixty right forwards. No Redoubts are to be made there, because if the Enemy should once possess them, it would be hard to dislodge them. It is also dangerous to make any Forts, because the Loss of one of them would open a Way for the Enemy into the Intrenchment; but if there be any higher Ground that might command the Camp, or advantageous Place within it, which might facilitate the rallying the Forces, in Case they were routed; there Forts may be made, provided there may be no Fear of losing them. The Ditch of them must be fourteen or sixteen Foot over at the Top, and five or six at the Bottom, and nine or ten in Depth: Pallisadoes and Stockades must also be fixed on the Edge of the Ditch faced with Sods, and *fraised* where there are no Sods; the Earth must be held together with Fascines, and well beaten down, and *Chevaux de Frise* placed in the Intervals. Men vary in their Opinion concerning the placing Pallisadoes. If they are placed in the Ditch, they may serve to help up Planks to come at the Parapet, and there may be *Ponts Volans*, or flying Bridges, laid on, so that the Ditch will be useless: But as it has this Disadvantage, it has also an Advantage, which is, that the Enemy cannot break in with their Cannon, as they can that on the Edge of the Ditch; and therefore where there is more Danger of a Surprise, than a regular Attack, I would advise to place it on the Edge of a Ditch; and in the Bottom, where they apprehend being attacked in Form.

The chief Skill of a *General* lies in the Art of encamping well: This the Romans were unacquainted with, 'till the War with *Pyrrhus*; from whose Camp they learned to model their own. 'Till then they knew not how to post themselves to Advantage, nor with any Order in their Camp.

Rhœ describing the great *Mogul's* Camp, says, it is twenty *English* Miles round, and contains more Space than the largest City in *Europe*; that it is composed of 800,000 Men, and 40,000 Elephants; and what increases the Miracle is, that all these Tents are pitched in four Hour's Time.

When the Army is encamped, and the Enemy is not very near, an eighth Part of the Army is generally upon Guard, and disposed according to the Ease, Difficulty, or the Consequence of the Avenues, for the Guard of Horse. During the Day-time if the Enemy be feared but one Way, one Half or two

Thirds

Thirds of those that mount the Guard shall be posted on that Side, about a Quarter of a League from the Camp, or somewhat further if it be a champaign Country. About an eighth Part is detached from that Guard, seven or eight hundred Paces further upon some Eminence, if there be any, which small Guard detaches one or two Vedets to be posted on the most advantageous Ground for Discovery. All Guards are to be posted that the Main-Guard may not be cut off from the Camp, nor the small Guards from the greater.

Note. There are several Kinds of Guards, as, 1. *Advanced Guard*, a Party of Horse or Foot, which marches before a Corps, to give Notice of approaching Danger. When an Army is upon the March, the *Grand Guard* which should mount that Day, serves as an *Advanced Guard* to the Army. That small Body also of fifteen or twenty Horse, commanded by a Lieutenant beyond, but within Sight of the *Main*, or before the *Grand Guard* of a Camp, are called the *Advanced Guard*. 2. The *Grand Guard*, which consists of three or four Squadrons of Horse, commanded by a Field-Officer, and posted before the Camp on the Right and Left-Wing towards the Enemy, for the Security of the Camp. 3. The *Quarter Guard*, which is a small Guard, commanded by a Subaltern Officer, and posted by every Battalion of a Camp 100 Yards before its Front. 4. The *Standard-Guard*, a small Guard of Foot, which a Regiment of Horse mounts in their Front under a Corporal. 5. The *Main-Guard*, from whence all the other Guards are detached. Those who are to mount the *Main-Guard*, meet at the respective Captain's Quarters, and from thence go to the Parade; where after the whole Guard is drawn up, the small Guards are detached for the Posts and Magazines; and then the subaltern Officers draw Lots for their Guards, and are commanded by the Captain of the *Main Guard*. 6. The *Piquet-Guard*, which is a Number of Horse and Foot, who keep themselves always in a Readiness in Case of an Alarm; the Horses being saddled, and the Riders booted all the while: The Foot draw up at the Head of the Battalion at the Beating of the Tattoo, but afterwards return to their Tents, where they remain in a Readiness to march on any sudden Alarm. This Guard is to make Resistance in Case of an Attack 'till the Army can get ready. A *Vedette* is a Centinel on Horseback, detached from the main Body of the Army, to discover and give Notice of the Enemy's Designs.

If the Country be inclosed, the *Main-Guard* must be so near the Camp that it cannot be cut off, but yet at such a Distance, that if the Enemy appears, they may give timely Notice; and to prevent the Army being surprized, they must send out little Guards of two or three hundred Horse on the Right and Left, who shall post *Vedettes* for their Security. The Commander shall from Time to Time visit the *Advanced-Guard* and *Vedettes*; and the Time of the Guard be so divided in relieving them, that every Man in his Turn may be upon the *Advanced-Guard*, who are not to dismount, except in a very open Place, and then the Horses must not be unbridled. The *Main-Guard* may unbridle half the Horses, the other remaining in Readiness. If the Country be inclosed, Scouts must be sent from Time to Time, some going strait forward, others a cross from one small Guard to another, to take Care that the Enemy do not slip in between. When the *Main-Guard* is ordered, the rest of the *Cavalry* shall be divided into two or three other Guards, to be disposed about the Camp; and they may be stronger or weaker, as there is Occasion.

The Guards of Foot are generally at the Head of their own Battalions, but if there be a Steeple,

Tower, or strong House near the Camp, a Guard of Foot shall be sent to it: So likewise if there be any Pass upon a River, or any deep Valley, about half a Quarter of a League from the Camp, and the Country be not much enclosed, a Guard of Foot shall be sent there at Night only. If the Pass be at a Distance, some Foot may be sent, supported by a Guard of Horse; but if the Place be too dangerous for the Foot, a few Horse may be sent to inform of the Enemy, or Scouts may be sent thither often. Every Regiment ought to send 50 Men, according to its Strength, every Night upon the Guard, at the Head of the Camp, commanded by a Captain and Lieutenant, or one of them, if there be Cause to fear any Thing.

When the Camp of the Foot does not cover the Horse, and is encompassed with Hedges and Ditches, a Guard of Foot is generally posted at the Head of them, to give them Time to mount in Case they are attacked. When there are several detached Guards, the Camp Guard is lessened, provided the others cover it; and the Major-General is to appoint the Guard of the Artillery as strong as he thinks fit.

When he has given his Orders he goes to meet the General, and shews him the Disposition of the Camp and Guards, and in the mean Time the Quarter-Master-General, shews the Majors of Brigades of Foot, and the Quarter-Master-General of the Horse, the Places where they are to be posted, and what Force each of them is to consist of. As for the other Particulars of the Guards, as from what Regiments they are detached, they are left to the Quarter-Master-General of the Horse, and the Majors of Brigades.

When the Major-General appoints the Guard for the Day, he shews the Place where they are to retire at Night, which is generally within two or three hundred Yards of the Camp. He is to visit them once in a Night, to see if they are posted according to his Orders; that is, whether the Officers are there, and their Number complete; whether the detached Guards are on Horseback, and half the *Main-Guard*, and the rest in their Rank, and Horses bridled; whether the necessary Number of *Vedettes* be posted for the Security of the Camp, and whether from Time to Time they send out their Scouts, who are to be sent from one *Vedette* to another, when there is a Possibility that the Enemy may slip between them and the *Vedettes*; or else the *Vedettes* being coupled, as they ought to be at Night, one of them goes as far as the others on the Right; and when he returns, his Comrade goes as far as the *Vedettes* on the Left, and thus they continue all Night. Scouts are also going continually about the Camp from one Guard to another.

The Guard of an intrenched Camp is quite different; the Intrenchment is divided among all the Foot, who post Centinels on it, so that there can be no passing between any two of them; and the Guard of Horse is weaker than when the Camp is open. It is posted within the Intrenchment in two or three Bodies, near the Barriers that are upon the great Avenues, and only send a small Guard 50 Paces without the Lines, who continually patrol, and send out Scouts on the Right and Left, and strait forwards.

But as we do not design to continue long in our Camp, to put our Friends to the needless Expences of coming to visit us, we have no need of using these Precautions, therefore we'll order the Major-General of the Day to make the Dispositions for the March, which he learns from the Number of the Battalions and Squadrons of which the Army is composed; what Enemies may be met in the March, and whether in Front, on the Right or on the Left; whether the Way be plain or woody, or incumbered with Hedges, Ditches, Marshes, or Rivers; whether there be one or several Roads or Defiles; how many Men, Horses, or Waggons can march in Front; and which is the soundest and evenest Way for the Artillery.

If the Enemy be in Front, and the Army in a Champaign Ground, he must march in order of Battle, with the Cannon in Front, the Horse on the Wing,

and the Foot in the Center; then the second Line, and after the two Lines the Train of Artillery, thro' as many Defiles as he can, that they may be the less Time in passing. Next the Train of Artillery, the Provisions, and all the Baggage of the *Army* opposite to its Regiments upon the same Line with the Train of Artillery; that is, the Baggage of the first Line foremost, and in the Rear the Baggage of the second Line, then the Baggage of the *Rear-Guard*, or *Corps de Reserve*, which *Rear-Guard* shall march after the Baggage, leaving only one Squadron in the Rear of them to prevent any Disorder, or running away; but upon Expedition the Artillery and Baggage march in two or more Columns.

Note. That a *DEFILE* is a narrow Pass or Way, through which a Company of Horse or Foot can pass only in *File*, by making a small Front, so that the Enemy may take an Opportunity to stop their March, and to charge them with so much the more Advantage, in regard that the Front and Rear cannot reciprocally come to the Relief of one another. The Word is derived from the *French*, *Deffile*, to unthread or unstring.

If the Enemy be in Front, and the Country be woody, or enclosed with Hedges or Ditches, advanced Parties of Scouts must march before, supported by some Platoons of Musqueteers, and those by Squadrons or Detachments of Horse, if the Country will prove fit for the Horse. If the Country be enclosed, so that the Horse cannot come to do Service, a Battalion is to march after the first Squadron, and so all the Horse and Foot are mixed; and as there are generally more Squadrons than Battalions, the Squadrons shall be equally divided among the Battalions, and each Squadron have Platoons of Musqueteers; and in this Manner the *Van-Guard* and main Body shall march, then the heavy Cannon, the Ammunition, Provisions and Baggage.

Note. That *PLATOON* is a small square Body of 40 or 50 Men drawn out of a Battalion of Foot, and placed between the Squadrons of Horse to sustain them; or in Ambuscades, Streights and Defiles, where there is not Room for whole Battalions or Regiments. The Grenadiers are generally posted in *Platoons*. The Word is formed by Corruption of the *French*, *Pilaton*, a Bottom or Clue of Thread.

The Field-Pieces are to march with the *Van-Guard*, and the heavier Pieces with the main Battle, and many Platoons in the Intervals between the Baggage, for Fear the Enemy should cut it off in the Wood; then the *Rear Guard* shall march. It is dangerous to place the heavy Cannon between the Battalions and Squadrons in a Country that is enclosed, because if they were to draw up in Order of Battle on a sudden, and the *Van-Guard* should be attacked it might hinder the March of the Troops, and can do them no great Service. However if the Country be enclosed in some Places, and open in others, they must draw up in Battle when they come into the Plain, if the Enemy be at Hand, and turn to their former Order when they have passed it. If there are several Roads they must draw up in two or three Columns, and at the Head of every one of them a Cart loaded with Tools, and a Number of Pioneers and Soldiers.

Note. That a *COLUMN* in War denotes a deep *File*, or Row of Troops; or a Division of an *Army*, which marches at the same Time, and towards the same Place, at Intervals large enough to avoid Confusion. An *Army* marches in one, two, three, or more *Columns*, according as the Ground will allow, and the *General* sees expedient.

Note also. That the *VAN*, or *Van-guard* of an *Army* is the first Line, and is the same with the Front of an *Army*, and gives the first Charge upon the Enemy. Every *Army* being composed of three Parts, a *Van-Guard*, *Rear-Guard*, and *Main-Body*. The *Rear-Guard* is that Part which march last, following the *Main-Body* to stop Deserters. The *Main-Body* marches between both, and is ordinarily the *General's* Post. The *Corps de Reserve*, are the Forces disposed in the third or last Line of an *Army*, and destined to sustain the rest, as Occasion requires, and are not to engage but in Case of Necessity.

The better to regulate the March, some *General Officers* should keep in the Rear of the Baggage, each according to his Post, except among the Foot, where the Baggage of the *Rear-Guard* march according to the Seniority of the Regiment, and those of the elder Regiments march foremost, though they make a Retreat. The Sutlers and other Trades, who do not belong to any particular Regiment, march after the Baggage of the main Battle. Every Regiment of Foot sends a Man out of each Company to guard its Baggage, under the Command of a *Serjeant*; and each Troop of Horse one Trooper. The *Provost-Marshal*, and all the other Provosts are to march with their Men, to see that the Soldiers keep their Ranks, and to prevent Disorder.

A *Captain*, or Conductor of the Baggage, is appointed, who puts the Baggage into the marching Order, and makes the *Guards* observe it as they march; and every Regiment puts up a Flag of the same Colour and Shape, that their Baggage may the better be kept together; and some of them are carried to the *Major-General* of the Day, who orders them to be placed at the Head of every Column of Troops and Baggage.

If the Enemy be on the Right Wing, and the Country plain, they must march thus. Those who are to compose the *Van-Guard* in the Order of Battle, are to be on the Right of those who are to compose the *Main-Battle*; the *Main Battle* on the Left of the *Van Guard*, and the *Corps de Reserve* on the Left of the *Main-Battle*; each of those Bodies making a *File*, with the Horse at the Head and in the Rear, and the Foot in the Center, so that when the Army halts, and each Line faces to the Right, the Order of Battle will be formed, provided the *Van-Guard* observes its due Distance in marching, and the Troops of the *Main Battle* keep opposite to the Intervals of the *Van-Guard*. The Troops that guard the Baggage are to be on the Left of all the rest, making the largest Front they can, that their *File* may extend almost as far as those of the *Army*, and they are to have but one Squadron on the Left. In this Order of Marching, all the Cannon must march on the Right of the *Van-Guard*, that it may be at the Head of the *Army* in case of Battle.

If the Country be enclosed or cut with Trenches, and the Enemy on the Right, the *Army* must march almost in the same Order as in the Plain, provided the Roads will admit it, or can be made without much Labour, as in the Summer when all Lands are enclosed; and all that is altered at that Time is, that the Column on the Right, which composes the *Van-guard*, shall be stronger in Foot, than that which composes the *Main Battle*, and each Squadron of the *Van-guard*, shall have *Platoons* of Musqueteers. The Cannon must march between two Columns, because it cannot do great Service in a Country that is enclosed; and if it were upon the Right of all, the Enemy might take it, or nail it, before it could be relieved.

If there be two Defiles, all the Troops are to march through that on the Right, and the Baggage through that on the Left; Part of the Field-Pieces in the Intervals of the *Van-guard*, part with the *Main Battle*, and some few with the *Rear guard*. The heavy Cannon

Cannon is to march in the Column of the Baggage, but not quite at the Head of it, lest the Enemy send some Troops to attack it, but after the Baggage of the *Van-guard*, that it may be the better covered by Troops.

The *Van-guard* files off first, then the *main Body*, and next the *Corps de Reserve*. If there should happen to be but one *Defile*, then all the *Van-guard* marches off first; the Artillery, the Provisions, and the *General's* Baggage next, then the *Main-Battle*, and all the other Baggage, and then the *Corps de Reserve*. But this is a very dangerous Way of marching if the Enemy be near, because the Lines being divided by the Baggage, they cannot come to succour one another: And on the other Hand, should all the Troops march together, and the Baggage after them, it would be too much exposed, and the Loss of it be as detrimental to the *Army*, as the Defeat of a considerable Part of the Troops; therefore to avoid this Inconvenience, the Baggage should in this Case march through another *Defile*, than that the Troops march through, though it were a League distant; and so they ought to have a Guard of a sixth or fourth Part of the *Army* according to the Force which it may be expected that the Enemy would send to attack it. In such a March it should have many small Parties of Horse if they can be had; if not, of Foot, to scour on the Right, and discover if the Enemy comes to attack it, at which Time Surprizes are most dangerous, because it is difficult for Troops when they are put into Disorder in a *Defile*, to rally. Parties should be frequently sent out towards the Enemy, that if one should happen to be cut off, the other might give Notice of it.

If the Enemy be in the Rear, the Order prescrib'd must be inverted; and when there are *Defiles* in the Way, great Care must be taken to make them easy, that the Troops may come to each others Succour, if the *Rear* should be attacked. The Field Pieces must be lodged on the Edge of the *Defile*, to favour the Retreat of the hindmost Troops, unless it be woody; if not, then many Field-pieces are more necessary than at another Time.

When there is little Cause to suspect the Enemy, and the Country is champain, the *Van-guard* marches in two Columns, then the *Main Battle*, and the *Corps de Reserve* after it; in the same Order, the Baggage between the two Columns, with the Artillery and Provisions in the Front; or else the *Van-guard* may march in three Columns, the main Battle in the same Manner, and the Artillery, Provisions, and Baggage after it, and last of all the *Rear-guard*, or *Corps de Reserve*.

If the Country be enclosed, and there is but one *Defile*, then let the *Van-guard* and main Battle march next the Artillery, Provisions and Baggage, and then the *Rear-guard*. If there are many *Defiles*, the *Van-guard* and *Main Battle* may march in as many Columns, then the Baggage after them, and the *Rear-guard* last; or else the Troops and Baggage may pass through several *Defiles*. When the Order of marching is resolved, the *Major General* is to acquaint the *General* with it, to know whether it meets with his Approbation.

Note, that AMMUNITION signifies all Sorts of warlike Stores, but more especially Powder and Ball. The Word is formed of the Latin, *A-monitio*, which according to *Du Cange*, was used, in the corrupt State of that Language, for *Subsistence*. AMMUNITION Bread, is what is provided for, and distributed daily to the Soldiers of an Army or Garrison.

But why should we amuse ourselves to give the Etymology of Words, and change my *Marshal-staff* into a Pen, while at the Head of an Army, and the Enemy is in Sight, and I must prepare for a Battle? Quickly let all my Officers be called to receive the Order for a general Engagement. But before we go

to the Enemy, let me instruct them how they are to behave themselves in Fight; therefore I will have all my Officers encourage and animate their Soldiers in the Combat, more by their Courage, Intrepidity and Valour, than by their Discourses; since a good Example makes a stronger Impression on their Mind than a studied and florid Discourse. I hope all the Horse Officers are well mounted, and have all chosen a Horse that has a good Mouth, for if he carries him into the Enemy's Squadrons, his Life or Liberty lies at stake; and if he takes the contrary Way, his Honour will be in Danger; for who can prevent ill Tongues from imputing such Accident to Cowardice. *Landresse*, Major of the Regiment of *Chate*, lost his Life for want of this Precaution; for his Horse being hard mouthed, and the Major pursuing a Soldier that run away, he was contemned by the Army, and to recover his Reputation was obliged to expose himself too much upon the first Opportunity, and had not the good Fortune to come off.

An Officer should not ride a fleet Horse on the Day of Battle, except he rides him usually at other Times, lest he gives Occasion to have it said, that he chose that Horse to run away the faster. He must take Care to have his Horse's Buttocks within the front Rank, and the Ranks so close, that they may not be broke; for the Strength of a Squadron consists in being kept close.—In Pursuit of the Enemy the Squadron must be kept in Order of Battle, and if they come to a *Defile*, make a Halt, till all are past, and then form again.—When a Battalion or Squadron is formed in the Face of an Enemy, the best Way is to form them by Ranks, and not by Files.—Where there are Ditches or Hedges, an Officer of Horse must take Care not to get too far from the Foot, lest he should want their Assistance; and therefore Platoons should be always placed between the Squadrons.—When the Enemy is routed, the Men must not stay for Plunder, for by that Means the Enemy will gain Ground and get off safe: and as there is a Season for all Things, it is not a Time to plunder, while the Enemy is before the Soldiers; for if this were allowed, the Enemy might rally, and change the Face of Affairs; besides their Flight may be a Stratagem, or an Amusement to get an easy Victory; and Armies have forsaken their Waggons and Baggage to deceive the Enemy, and to fall upon them when they thought themselves securest.—There are Rules for plundering as well as for every Thing else, and Detachments are generally appointed for it; but such is generally the Greediness of Soldiers; that unless the Officer stops them, they will not have so much Patience. Prisoners taken in Battle are to be put into the Hands of Men detach'd to secure them.—If Soldiers will not refrain from Plunder when they are ordered another Way, one of them should be shot, as an Example to the rest; and they who survive, will have the more Value for the Officer when they come to themselves, and acknowledge that he was in the Right.

These few Salutary Advices are not out of Season, especially at the Eve of a Battle; as we are at present.

A BATTLE (for I cannot help giving a Definition before I proceed further) is an Action which passes between two Armies ranged in Order of Battle, and who engage in a Country sufficiently open for them to encounter in Front, and at the same Time, or at least for the greater Part of the Line to engage, while the Remainder is in Sight, by Reason of some Difficulty which hinders it from entering so readily into an Action, with a Front equal to that which may be opposed to it by the Enemy.

Other great Actions, though generally of a longer Duration, and even frequently attended with greater Slaughter, are only called *Fights*; by the *French*, *Combats*.

A Battle lost, almost always draws with it the Loss of the Artillery of the Army, and frequently also that of the Baggage: Consequently as the Army beaten cannot again look the Enemy in the Face, till it have repaired

paired those Losses, it is forced to leave the Enemy a long Time Master of the Country, and at Liberty to execute all its Schemes.—Whereas a great Fight lost is rarely attended with a Loss of all the Artillery, and scarce ever of the Biggame, because the two Armies not meeting in Front, they can only have suffered in the Part that has been engaged.

An ingenious modern Author remarks, that it is not usually the Loss sustained in a *Battle* (that is of some Thousands of Men) that proves so fatal to a State; but the imaginary Loss and Discouragement, which deprives it of the Use of those very Powers which Fortune had left to it.—The History of *Battles* are only the History of the Faults and Oversight of *Generals*: Luckily enough the Mistakes of the two opposite Commanders generally ballance one another: One of them makes a Fault, and the other overlooks, or does not take Advantage of it.—*Monsieur de Feuquiere's Remarques sur la Guerre*, are little else but a Recital of Mistakes on both Sides: he scarce speaks of a modern General, except *Turenne*, *Luxembourg*, and the Prince of *Condé*, whose Conduct was not full of them: *Crequi* and *Catinat* were guilty of great ones, which however they compensated by their judicious Conduct on other Occasions.—But to avoid, on our Side, being branded with the same Reproaches, we'll endeavour to make all the best Dispositions we can, and take all the Precautions imaginable, to gain a complete Victory.

Therefore we must so contrive the Order of *Battle*, (supposing that we are already acquainted with the Number, Posts, Strength, and Names of the Troops which compose our Army, but also with the Ground we are to engage on, and what Nations make up the Troops of the Enemy, what is their Strength in Horse, Foot, and Cannon, and their Manner of fighting,) that all the Troops may support one another without Confusion, that when one Body is broke it may not bear down another; and they should make the largest Front, as well to prevent being out-flanked by the Enemy, if they are in more open Order, as to enclose them if they are in a narrow Compuls. And yet they must not be extended so much, that when one Body is broken, there may be none left to support it, and to oppose them that have routed it; or that the Battalions and Squadrons should be so distant, that if two of the Enemies should happen to join one of ours, those on the Right or Left of it, could not come to its Relief before the Enemy had broke it.

To keep a due Proportion, we must draw our Army in two Lines, viz. The first and second Line, which must be of equal Force, and the *Corps de Reserve*.—The Foot shall be placed in the Center, and the Horse on the Wings.—The Squadrons from one hundred and fifty Men each, at least, to two hundred at most, and but three deep.—The Battalions of five, six, or seven hundred at most, and drawn up three deep.—If our Army consist of forty Squadrons, and eighteen Battalions, we should place sixteen Squadrons, and eight Battalions in the first Line, sixteen Squadrons and seven Battalions in the second, and eight Squadrons and three Battalions in the Rear guard, or *Corps de Reserve*.—Or else in the first Line place fourteen Squadrons and nine Battalions; in the second, sixteen Squadrons and five Battalions; and in the *Rear-guard*, ten Squadrons and four Battalions.—Or else in the first Line, let there be sixteen Squadrons and ten Battalions, in the second, seventeen Squadrons and six Battalions, and for the *Rear-guard*, seven Squadrons and two Battalions.

The eldest Corps has the Right, the next the Left, and so on according to Seniority, till the youngest meet in the Center.—The first Line is more honourable than the second, and the second than the *Rear-guard*.—The Guards are always in the Line of Battle, and the Carabineers and Fusileers are on the Wings, somewhat advanced before the other Troops.—The Space of two hundred Paces is al-

lowed for the Distance between the first and second Line, and one hundred between the second and the *Rear-guard*.

Note, That the CARABINEERS are a Sort of Light-Horse, carrying longer *Carabines* than the rest; and used sometimes on Foot. The *French* of late have formed entire Corps of these *Carabineers*, which cannot but have good Effect; this being a Sort of Soldiery chosen out of the whole Cavalry, and better paid than the rest. FUSILEERS are Foot-Soldiers, armed with Firelocks which are generally slung. There is a Regiment of Fusileers for the Guard of the Artillery.

The Battalions and Squadrons of the second Line are placed opposite to the Intervals between those of the first Line, that they may march through the Enemy; and those of the first Line, if broken, may pass through the Intervals of the second without Disorder to either. The Intervals are to be half the Breadth of the Front of the Battalion or Squadron that it sustains, when doubled from three to six. It has been found of Service to place all the Foot almost in the two first Lines, as being very near useless in the *Corps de Reserve*, because they cannot come Time enough to relieve the Troops that are bore down. More Foot should be placed in the first Line than the second, and their Place be supplied in the second by some Squadrons, which would do great Execution, coming up to charge between the two Battalions, after they had spent their Fire: Besides the Foot would be greatly encouraged, who love to be sustained by the Horse, and the Horse would charge with more Alacrity, after the Foot have given their first Volleys; and the Fire of the Battalions has more Effect when the first Troops have the Offset, than when they are mixed, and in Confusion; and it often happens that the Battalion of the second Line do not spend half their Fire, being come up to Push of Bayonet before they make their Discharge.

The Cannon must be placed in Brigades before the first Line, reserving some few Pieces an hundred Paces behind the *Corps de Reserve*, guarded by a small Number of Men to favour a Retreat, or prevent being attacked in the Rear. If there be any rising Ground, either in the Front, or on the Right or Left, the utmost Efforts must be made to gain it, in order to plant the Cannon there, and prevent the Enemy taking the same Advantage of it; and sometimes a general Battle has been changed into an Engagement of Regiments against Regiments to possess an advantageous Ground; and the Time being thus spent till Night, both Parties are obliged to draw off, each finding their Troops much weakened, not knowing the Damage on either Side.

The Army being drawn up, 'tis best to charge the Enemy before they are in order of Battle; but if their Ground be more advantageous than ours, as being to mount a rising Ground, or to pass a Brook, Ditch, or hollow Way, 'tis better to expect their coming than to attack them, except we be much superiour to them in Number, and our Cannon be posted to Advantage.

When the first Line or *Van Guard* advances, let the second move also, keeping equal Pace with the first, and leaving a small Interval between them, lest the first should be broke before the second can march up to relieve it; or if it should break the first Line of the Enemy, lest their second Line may relieve it before ours can march up to sustain our *Van Guard*.

The *Corps de Reserve* must advance gently towards the Enemy, that the broken Troops may have Time to rally, and they must engage all at once, and it must be always observed to give them Time to recover their Spirits.

The *General*, if the Distance of Ground hinders his Sight, must send an *Aid de Camp* to know how Matters go through the whole Army, that he may either

push on his Advantage, or go in Person, or send Succours to those Troops that suffer.

No Prisoners, except they are Men of Note, must be taken until the Victory be certain, nor the Horse or Foot be permitted to plunder; but when we are Masters of the Field, rally our Men immediately, and send some Squadrons after the Enemy to take Prisoners, and observe whether they rally in Order to renew the Charge.

When the Victory is complete, and our Forces not over-fatigued, we must send a strong Party to pursue the Enemy to the Gates of their next Town, or to some Defile, where there are often as many Prisoners taken, as in the Field of Battle.

If one Part of the *Army* has the better, and the other be worsted, we must nicely observe whether the Enemy have not a greater Advantage over that Part whom they push, than we have over those Men where we are successful; and if our Advantage be greater than theirs, we must not withdraw any of our victorious Troops to succour the others, 'till they have entirely defeated those that oppose them; but if the Enemy presses more vigorously upon one Part of our *Army* than our other presses theirs, we must then send as many of our victorious Troops as can be spared to succour the rest; and Care must be taken that the Troops which give Ground be sustained by those behind them, and make them rally as soon as possible.

While there remains any Hope of gaining the Battle, the rally'd Forces must charge again; but if their Number be so small in Comparison of the Conquerors, that all Hopes are lost, then retreat in the best Order, and rally again as near the Field of Battle as you can, that you may be in a Condition to oppose any small Bodies of the Enemy that shall pursue you, and with the Remains of your Troops throw yourself into the next considerable Town, which in all Probability they will first attack.

A VICTORY depends as much on the Judgment, Prudence, and Presence of Mind of a *General*, as on his Valour, and on the Strength and Courage of the Forces he commands; since with those excellent Qualities he is capable, not only to range his *Army* in good Order, and make the necessary Dispositions above-mentioned, but likewise rectify the Mistakes and Oversights which might happen during the Engagement, to send the necessary Succours to the Right and Left, as it is wanted, to moderate the too great Impetuosity of some of his Forces, and to animate the others to fight with Courage. A good *General* should act as a *General*, without forgetting that he is also a Soldier, and act as a Soldier without forgetting that he is a *General*, on whose Preservation the Success of the Day entirely depends. After the famous Battle of *Senef*, fought between King *William*, while yet but Prince of *Orange*, and the Prince of *Condé*, the greatest *General* of his Time, the Prince of *Condé* complimented the Prince of *Orange*, saying, that he had behaved in that Action as the most experienced *General*, but at the same Time reprimanded him for having exposed himself too much, like a young Man; for in a Battle there is some Respect shewn to a *General* while in his Post, but none when found fighting like a common Soldier.

A *General* must be likewise very careful of his Troops, and not send them to attack a Post without, at least, some very great Probability of Success, otherwise it would be sending them with a premeditated Design to the Slaughter, which was a very great Fault in the Prince of *Condé* here mentioned, who did not care how many Men he lost, provided he could gain the Victory, saying, that 15,000 or 20,000 Men were but a Night's Work at *Paris*; and who at the Battle of *Senef*, sent the Chevalier *de Fourille*, to attack a Body of Cavalry posted upon an Eminence, which he knew could not be done with the least Appearance of Success; but the Prince hated *Fourille*, and was glad of the Occasion to sacrifice him to his Hatred as he did, for the Party commanded by *Fourille*,

was almost cut to Pieces, and himself mortally wounded, of which Wound he died a few Moments after, wishing to live only one Hour longer to see, said he, how that Butcher, meaning the Prince of *Condé*, would extricate himself out of that dangerous Affair, wherein 20,000 Men were killed on both Sides, *Condé* gaining no other Advantage, but on the Side of the Prisoners, having taken whole Regiments of them.

Turenne, who commanded at the same Time, and at another Place, another of the King of *France's* Armies, follow'd a quite different Method; for the Life of the meanest Soldier of his *Army* was as dear to him as his own, and he was as careful of it, oftener conquering the Enemy, by his Marches and Counter-marches, than in pitched Battles. They often expected to meet with him at one Place, when he was 20 or 30 Leagues from it, and while they were pursuing him thither, he was come back to the Place they had left last; and after he had long harrassed and weakened them in that Manner, he was on their Heels, while they thought him far off, and when they were halt conquered by the Fatigues of the March.

No General had ever a greater Presence of Mind than the late Duke of *Marlborough*, of immortal Memory, for he was as sedate and calm in the greatest Heat of the Battle, as if he had been in the Queen's Cabinet, giving then his Orders with as much Tranquillity and Prudence, as he could have done his Sentiments on some State Affairs.

The *French* had at that Time a *General*, viz. *Villeroy*, of a quite different Disposition; 'Tis true, that no *General* has ever made finer Dispositions for a Battle than *Villeroy* did, but as soon as the Cannon began to roar, he seemed to have lost the *Tremontane*, which made the *Duchess of Bourbon*, say of him, *Il avoit bien Cent Mille Bras, mais il n'avoit point de Tête*, i.e. He had an hundred thousand Arms, but no Head.

A *General's* Conduct is as often commended in a Retreat as in a Battle, and his Intrepidity and Courage as much signalized. As it cannot be reasonably expected he should fight to too great a Disadvantage, proceeding either from the too small Number of his Forces, when compared with those of the Enemy, or from the Situation of his *Army*, or from his Provisions being cut off, or from the imminent Danger of being surrounded by the Enemy, so as to be forced to surrender, or to be cut to Pieces, &c. and that the Reputation of a *General* is almost always lost in a Flight; he must have some Means left to extricate himself from those Difficulties, with Honour, which cannot be done otherwise than by what's called an honourable Retreat, which, under the above-mentioned Disadvantages, must be made with all possible Expedition, even though the *Army* should lose some Soldiers that could not keep up with it, and a *General* must not quit all, or any Part of his Cannon, except the utmost Necessity compels him to it: But for the Baggage, if the Retreat be not easy, he must incumber himself with as little as may be; and if he is so hard pressed that he must unavoidably come to a Battle, he must chuse an advantageous Opportunity for himself, endeavouring to draw up behind a Wood or Hill, that he may fall upon the Enemy's Flank; or else as they pursue him, making a quick Counter-march, after passing a Defile, that he may engage one Part of the Enemy's *Army* before it can all join together. In such Cases of Compulsion there is no counting the Number of Men; for though you are but half or the third Part of their Number, yet you may lay hold of such an Opportunity, and with such Resolution that you may defeat them.

If you are so weak that nothing can be done by fighting, or speedy marching; or, if a too powerful Number of the Enemy have got before, and hinder your passing; then the last Resolution to be taken, is to preserve what may be saved, dividing the *Army* into four or five Bodies, which must march several Ways to make their Escape; and thus the Enemy not being